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It's a Team Game:

Exploring Factors That Influence Team Experience

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Submitted for the degree of Doctor of Philosophy

University of Sussex

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Declaration

I hereby declare that this thesis has not been and will not be submitted in whole or in part to another University for the award of any other degree.

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IT'S A TEAM GAME:
EXPLORING FACTORS THAT INFLUENCE TEAM EXPERIENCESUMMARY

Many multiplayer games feature teams, and whether they are pitted against each other or against the game itself it seems likely that the way these teams bond will affect the players' experience. What are the factors that influence the experience of being a team member in a game? To what extent can the game designer manipulate the cohesion of the teams by changing the game design? How does the satisfaction of the player with their team relate to their feeling of cohesion? How does cohesion differ between tabletop and online games? These issues become particularly important where the group dynamic is central to the desired outcome of the game e.g. educational games aiming to place the players in specific social situations.

Four studies were conducted on four similar simulation games (two tabletop, two online) used for teaching in International Development Studies. These games explore farming in sub-Saharan Africa and require 12-30 players to play in small groups. The group dynamics are important for the learning outcomes. Similar groups of participants (all students of International Development Studies) played one game each. Each group played for 3 hours before completing a questionnaire about their experience and wrapping up with a full-group reflective discussion.

Results from the two tabletop games suggested that, as expected, altering the rules of the game manipulated levels of team cohesion. However, the lack of significant result from the two online games suggests that careful design is required to achieve the same outcomes in the online environment. This suggests that seemingly small changes between tabletop and online implementations may impact the game play experience in unanticipated ways. The team cohesion reported by the players was found to correlate strongly with the team member satisfaction levels of the players. The gender composition of the teams was shown to have a large impact on both team cohesion and team member satisfaction: having one or more females in the group significantly increased both measures.

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Publications

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- Martin, E. and Good, J. (2013b). The Relationship Between Game Rules And Team Cohesion : An Empirical Study. In Christou, G., Law, E. L.-C., Geerts, D., Nacke, L. E., and Zaphiris, P., editors, *CHI2013 workshop on Designing and Evaluating Sociability in Online Video Games*, pages 1–4
- Martin, E. and Good, J. (2013a). A Study of Team Cohesion and Player Satisfaction in two Face-to- Face Games. In *Proceedings of DiGRA 2013*, number 2007, page Paper 288
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Chapter 1

Introduction

1.1 Background

Since 1999 there has been an explosive growth in multiplayer gaming online ([Van Geel, 2012](#)). Most face-to-face games – including boardgames, sports, role-playing games, live-action role-play, table-top war-games and others – are also multiplayer. Many games of all kinds require the players to play as part of a group or team. It might well be assumed that the way the teams bond would affect the players' experience of the game – a team with a great deal of in-fighting is just not as much fun to be part of no matter how good the game is. Game designers would presumably prefer that players focus on the game rather than issues within their team, and games companies may see greater loyalty from a player who has formed strong bonds with a group of fellow players. When playing serious or educational games, the player may not learn as well if they are distracted by problems with their team. Forming strongly bonded teams therefore seems to be of wide general interest.

Many multi-player games currently appear to rely on either making the task too difficult to complete alone, e.g. there are just too many enemies to complete a given mission alone, or by making them physically impossible, e.g. pressing two buttons on opposite sides of a room simultaneously ([Knizia, 2004](#)). This does not appear to reliably create long-standing groupings; for example many guilds in World of Warcraft have a life of less than a month ([Williams et al., 2006](#)).

It is not particularly controversial to suggest that the rules of the game affects the behaviour of the players. The rules of the game do, after all, define what is and is not possible within the game. The goals that the players are striving to reach (whether those defined by the game designer or the player's own goals) can only be accomplished

by working with the game rules. Behaviour that is completely reasonable in one game therefore becomes completely unreasonable in another. For example, squash and tennis both involve hitting a ball with a racquet. However, in squash the rules define the playing area as an enclosed space that the players are confined within, whereas in tennis it is a more open space. Therefore in squash it is a reasonable tactic to turn one's back to most of the court and hit the ball away from the target wall, letting it hit the back of the court and bounce to the front. Such a tactic in tennis would automatically give your opponent the point¹.

The way that players in a team game feel about their teammates is equally obviously going to be affected by a wide range of factors. Is it possible that the rules of the game affect the way they feel about the other players? If so, which aspects of the rules will have the most effect?

The way that groups form has been studied in many different ways. From [Tuckman and Jensen \(1977\)](#) with “forming, norming, storming, performing”, to [Wenger \(1999\)](#) and communities of practice, all seem to agree that a group goes through some kind of initial formation process. This formation process is where the members define themselves as a group, what that entails and what that group membership means to them. The phase after that formation period is where the group starts to function at its best. Some groups never actually make it past the formation phase, falling apart before reaching their peak. Is it possible to help groups pass through the formation phase more quickly and more reliably?

One way to do this might be to increase the sense of belonging or cohesion that a player feels with their team. So what are the conditions that may affect the cohesion of the group, and is it possible to implement these within the rules of a game?

1.1.1 Social Identity Theory

Social Identity Theory (SIT) was formulated by social psychologist Henri Tajfel in the 1970s. He began investigating in-group identification, particularly in the context of intergroup conflict ([Tajfel and Turner, 1979](#)). This is relevant to the situation in most team games, where an element of team competition could well be described as intergroup conflict (albeit one hopes that this stays within the magic circle of the game).

SIT posits that when three or more people believe they share a set of common features that differentiate themselves from other people, a group exists. The sense of belonging

¹It may do in squash, depending on the strength of the player, but technically it is possible.

to the group informs the group members' sense of identity, both in terms of what they are (or feel they should be) and what they are not. This has multiple components – the cognitive component (knowledge of group membership), affective component (emotional involvement with the group) and evaluative component (is this a good or bad group to be a member of?) (Ellemers et al., 1999). Each individual has many different group memberships, ranging from the large (e.g. British, or female) to the small (Sussex HCT lab group member). However, it has been shown that only one of these multiple identities is salient at any given moment. Which identity is salient depends on the situation – in a room full of men it might be the identity of a woman that is most salient, or perhaps the context of a conference brings out the researcher identity. It depends both on the situation and the accessibility of the identity. The identities that someone uses most frequently will be more accessible than others which may require very specific circumstances to trigger (Oakes, 1987).

Since the 1970s SIT has been developed, and experiments conducted to investigate the way that different group situations affect the strength of the in-group identification and therefore team cohesion. These will be discussed in greater depth in section 2.4.1. Some of these conditions could potentially be replicated within the rules of a game, but it is not necessarily clear that this will be enough to create the stronger bonds found in other social environments between the game players.

1.1.2 Team Member Satisfaction

If a team is cohesive, will the members of that team be satisfied with their membership of the team? It does not necessarily follow that this will be the case: individuals are not made blind to the social standing of their group, even when they strongly identify as part of it (Spears et al., 1999). So what is the relationship between this construct of team member satisfaction and team cohesion? And how do manipulations of the game rules affect the satisfaction that the participants feel?

1.2 Research Questions

This research explores the factors that affect the team cohesion and team member satisfaction in small groups that form during the course of a game. This thesis focuses primarily on the effects of the game rules on the players and their groups, and differences between online and face-to-face gaming environments.

Specifically, this thesis considers the following research questions:

- RQ1: To what extent do the real-world findings from Social Identity Theory translate to game worlds? What effect does changing the game rules have on the team cohesion levels reported by the players?
- RQ2: How does the level of in-group identification reported relate to team member satisfaction?
- RQ3: What is the effect on both team cohesion and team member satisfaction of moving the game from a face-to-face to an online condition?
- RQ4: How do more individual factors such as the players' self-reported preference for group work or the number of people they know in their team affect the team cohesion and team member satisfaction as reported by the player?

1.3 Context for the Work

This work was carried out as part of the Green Revolution project, funded by the Future Agricultures Consortium via a grant from the UK Department for International Development. The aim of the Green Revolution project was to design and implement an online learning game called the *African Farmer Game*. This game was to be based in a rural community in Sub-Saharan Africa. The target user-group for the game was to be students of International Development, with some potential to be used with policy makers in the future. The aim of the game was to provide the players with some empathy for the small-scale farmers they may encounter in the course of their work, by allowing them some small taste of the complex decisions and uncertainties faced by these farmers, and the potential outcomes of their decisions (both positive and negative).

Within this problem space there already existed a series of face-to-face simulation games, the earliest of which was the *Green Revolution Game* (GRG) – created in 1982 (Chapman and Dowler, 1982) – which focused mainly on the growing of rice in rural India. Several variants of this game were made to explore different aspects of rural life, and *Africulture* (Chapman et al., 1993) was created to explore the gender roles in an African rural village. These two games were presented by the project sponsors as the starting point for the *African Farmer Game*, and will be discussed in greater detail in Chapter 4. The design and implementation of the *African Farmer Game* will also be discussed in Chapter 5.

The project sponsors were experts in farming technologies utilised in this geographical area and had a great deal of teaching experience, but had limited experience with online

games or software design. They primarily acted as subject matter experts and clients throughout the project. The research conducted within this thesis was not a primary aim of the project and this shaped some of the design of the research as it limited the extent to which the game made could be specifically tailored to the research.

1.4 Programme of Work

An initial literature review was carried out to explore the current understanding of the effects of changing games has on player experience and to gain an understanding of Social Identity Theory. The initial design and build of *The African Farmer Game* took a substantial amount of time in 2011 and continued throughout 2012. Alongside this work on the game the questionnaire was designed in early 2012 and two studies on the face-to-face games were undertaken in the same year. An expert review of the online game was carried out in early 2013 to ensure that the game was ready for use, with the final two studies conducted later in the year. Work on *The African Farmer Game* continued throughout the final year, as feedback from the evaluations and the studies themselves was used to improve the game.

1.5 Outline of Thesis

This work was carried out as a series of four field studies. Each study used a different game: *GRG*, *Africulture* and two versions of the *African Farmer Game*. All of the games were played according to the original rules. The following chapters describe these studies and the findings in more detail:

Chapter 2: Literature review

This chapter gives an overview of relevant literature and reports on related work to provide a theoretical background to the current research. It starts by considering groups in games in particular (including details of two games used in these studies), before broadening out to look at theories of groups in general. Factors relevant to team cohesion are investigated, before delving into the literature on team member satisfaction. The differences in games in the online condition versus the offline are also discussed.

Chapter 3: Experimental Procedure

This chapter describes the design of the studies, including an overview of the games

used and detail of the design of the survey instrument used. A description of the participants and procedure follow, highlighting the similarities across all four studies.

Chapter 4: Tabletop games

This chapter introduces the two table-top games in more detail, and describes specifics of the participants and study procedure as applicable to the studies with these games. The results from these studies are presented, with a discussion of the results with reference to the relevant research questions.

Chapter 5: The African Farmer Game: Design, Implementation and System Description

The *African Farmer Game* was built as part of this project. This chapter gives more detail on the background, design and implementation of this game, including the procedural game play, the technical detail of the solution and the user interface design. A brief account of the users' reaction to the game is also described.

Chapter 6: Online Games

The second variation of the *African Farmer Game* is described, along with the specifics of the participants and procedure for the two studies using the two variants of the game. The results of the studies are presented and discussed in relation to the relevant research questions. Differences between the online and tabletop conditions are highlighted where found.

Chapter 7: Beyond The Game Rules

Factors beyond the game design and condition are considered across all four games. The results are presented and discussed with reference to the research questions.

Chapter 8: Gender Differences

This chapter examines the results for team cohesion and team member satisfaction for different player genders and different team gender compositions. Some of the data in this chapter was initially published in [Martin and Good \(2014\)](#), but has been broadened to include results from all studies for inclusion in this thesis.

Chapter 9: Conclusions

In this chapter the research questions are revisited, with conclusions drawn from findings across the thesis chapters. The key contributions of the work are summarised, and future work to extend, examine and strengthen these conclusions is suggested.

Chapter 2

Literature Review

2.1 Introduction

This chapter reviews the literature on groups in games, and the factors which may contribute to the experience of participating in a team. An initial overview of groups in games is provided, exploring face-to-face, online and educational games (specifically including background information on the two pre-existing games used in these studies). Then a brief overview of some theories of small group development is provided, before a detailed examination of team cohesion: what is understood by the term, and various theories and factors that may affect it. Team member satisfaction is further examined after this, and finally the potential differences in online and offline games are considered.

2.2 Groups in Games

Throughout the history of games many have been for multiple players. [Gutschera \(2009\)](#) identifies several different ways in which a game can be multiplayer:

- Two player;
- Two-sided team games;
- One-sided team games (e.g. against a board or artificial intelligence);
- Multiplayer or multi-sided games (e.g. more than two players or teams pursuing their own objectives);
- Massively multiplayer (where the number of people interacted with is far fewer than the total number of players).

The focus of this thesis is on the groups in games, where the total number of players is more than two, and players either have to form teams or (in the case of massively multiplayer games) may choose to do so. This list of game types does not prescribe the medium of the game, and all types can be seen in both online and offline environments¹.

There are games that do not make any attempt to force the players into groups, and could be played by single players or teams interchangeably. Alternatively, there are a number of ways that games can enforce or encourage team play. In sports this is often done by restricting the areas that a given player is allowed to access (e.g. netball, where players are limited to certain thirds of the court), making the playing area too large to be covered adequately by a single player (e.g. soccer, rugby, field hockey, or the change of court size in tennis doubles), or by having actions that need to take place simultaneously in different locations². This last tactic is also seen in multi-player puzzle games such as *Portal*. Another tactic seen in sports is the diversification of skills, so that players can specialise e.g. wicketkeeper or bowler in cricket, goalkeeper in soccer or field hockey and so on. This is a tactic that can be seen in board games (e.g. *The Lord of the Rings – Knizia*, 2004) and in the online gaming world. Almost every massively-multiplayer online role playing game (MMORPG) features some kind of “class” system, consisting of different types of player character with varying strengths and weaknesses (e.g. *World of Warcraft* – Ducheneaut et al., 2006). The final tactic which tends to be seen in online games is making the game too difficult for a single player, often by sending too many foes for a single player to handle alone.

Although strong groups often form around the meta-game (e.g. football fans), these groups are held to be outside of the current area of interest. Only groups that form during the playing of the games will be investigated.

2.2.1 Board/Tabletop/Face-to-face Games

The history of face-to-face games appears to be almost as long as human history itself (Avedon and Sutton-Smith, 1971). Often these are games that are played between two individuals (e.g. Chess, Backgammon, Battleships etc) although many card games and board games are designed for a greater number of players. Games like Bridge require

¹Yes, even massively multiplayer! Alternate Reality Games (ARGs) such as Google’s *Ingress* can be played by thousands, and some battle reenactments can be considered as Live Action Role Playing (LARP) and include a similar number of players.

²Or nearly simultaneously, as in cricket or baseball – the bowler or pitcher normally cannot move quickly enough to cover the hit and needs the rest of their team.

teams, as do many tabletop role-playing games.

Linderoth (2011) conducted a review of a variety of popular collaborative board games, with the aim of analysing the way that the different game designs influenced players' activities and group interactions. He found that some games used a one-sided team approach, with all players sharing the same goal of beating the board. The problem with those games from a group perspective was that the experienced players tended to dominate the group, accidentally excluding the inexperienced game players who felt they had no input ("game direction"). The other type of collaborative game they found used a "tragedy of the commons" mechanism: the players have their own goals, but if they pursue these at the cost of the group the system falls apart. With this type of game, the experienced players did not take over, but players failed to cooperate well. Others used a "traitor" mechanic³, where one of the players secretly works for the board to undermine the group activities. Again, this was found to cause major mistrust and the cooperative dimension of the game suffered. Linderoth (2011) went on to design a collaborative board game to overcome the issues of game direction using anonymous actions, and found that the game produced a strong team spirit amongst the players.

2.2.2 Online games

Looking more specifically at online games, there are two types of group available to players: a "pick-up group" (PUG) of random players, or a group of players that play together regularly. These organised groups (or teams) are given different names in the different games – for example, *World of Warcraft*, *Everquest* and *Guild Wars 1 and 2* feature "guilds", *Lineage* and *Call of Duty* both use "clans", while *Aion* calls these groups "legions". However, guild is a term recognised across games and will be used throughout this thesis to talk about organised groups in MMOGs.

Ducheneaut et al. (2006) performed a longitudinal study on the MMORPG *World of Warcraft*. As researchers they initially played the game, with each researcher playing several different characters, to gather qualitative data from the game. They also gathered quantitative data from the game, using an in-built command that lists details of all of the players logged in on a given server. This data was gathered once every 5-10 minutes, and allowed them to build up details of players' activities. They found that 60% of the players in the game were members of a guild, and that increased to 90% amongst the

³A game mechanic is a rule or set of rules which combine to produce a given type of play. A game may use one or more likely a combination of game mechanics. Game mechanics tend to relate to the rules and system of a game rather than the interaction design.

more advanced players (those who had achieved level 43 and higher). Belonging to a guild apparently increased the time that players spend in game and smoothed out some of the fluctuations in time spent that had been related to game structure (e.g. the game rewards odd numbered levels more than even, causing players to be less motivated and play less in even levels). However, they found that there did not appear to be a high commitment to guilds, with a relatively high turnover in guild membership observed, and a high “death rate” of 13% of guilds consisting of more than one member disappearing in a one month period.

[Williams et al. \(2006\)](#) also researched the guilds in *World of Warcraft*, focusing on the structures of the guilds that formed. They utilised a combination of qualitative ethnographic research and a more quantitative data-gathering ‘bot’, and followed up with in depth interviews with players. They found that the basic guild structure showed variation on three different axes: size, goal and membership.

They found that 20% of guilds had only one member, with the players’ using the guild name as a kind of “personalised numberplate” that showed up under their character name. These guilds were not groups at all, but the percentage of players doing this was small. As the group size increased above one, [Williams et al. \(2006\)](#) found that there were some general differences in the goals, with smaller groups being focused more on socialising whilst larger groups tended to be more focused on game goals. Larger guilds displayed increasingly formal management structures, with the largest also maintaining external websites and message boards. Within these larger groups, sub-groups tended to form. The smallest groups (fewer than ten members) tended to be groups with ties outside of the game.

The “guild churn” was explored in more detail, with common reasons for leaving guilds being a mismatch between the group and individual objectives, poor leadership, lack of players of their level, and the wrong level of seriousness – both too high and too low ([Williams et al., 2006](#)). Some people found that the game became more like work than fun, and quit both game and guild ([Yee, 2006b](#)). [Ducheneaut et al. \(2007\)](#) quantified the level of churn to be at 25% per month (e.g. for a guild of twenty, five members will have left in the previous month), and found that to be relatively consistent across guild sizes. They went on to explore the structural factors of the guilds that may affect the longevity of the guilds, finding that bigger guilds were more likely to survive (although members of smaller guilds were faster to progress through levels), as were groups with a wider spread of levels⁴ in their players. Guilds with smaller sub-groups and a greater

⁴The level that the player has attained within the game reflects the amount of time and effort that the

number of connections within the guild were more likely to survive, as were guilds that were most frequently seen in difficult areas of the game (which the authors suggested was indicative of a higher level of group organisation and cooperation).

All of the research presented above reflects the wide range of guild structures that can be achieved within *World of Warcraft*. The guild memberships appear to be relatively fluid, with a low apparent cost for leaving a guild. However, [Williams et al. \(2006\)](#) also found that players preferred the stability of the guild (for what it is worth) to the completely random PUGs. These appear to offer much more scope for group conflict, with misunderstandings about goals, levels of seriousness, tactics etc.

2.2.3 Educational games and learning

The use of both groups and games in educational settings has been widely researched. Small-group learning has spread, and is currently utilised in schools, universities, adult training programs etc. across the world ([Johnson and Johnson, 2009](#)). Much research has been done on the topic, including work on the best practices for producing good learning outcomes in small-group situations, both with and without computer support (e.g. [Cohen, 1994](#), [Van den Bossche et al., 2006](#), [Johnson and Johnson, 2009](#)).

Games also have a long history in the classroom, right back from the earliest war gaming examples in the 18th century ([Avedon and Sutton-Smith, 1971](#)). Whilst war games (both paper- and computer-based) are apparently still widely used in military education ([Dunnigan, 2000](#)) simulation games have long since branched out from that military beginning, and have been and continue to be used to investigate a wide range of situations ([Bell, 1975](#)).

One of the criticisms of using games in any educational setting is that the game goals frequently get in the way of the learning goals ([Egenfeldt-Nielsen, 2006](#)). It is therefore important that the game goals and the learning goals are at the very least complementary. The process of finding and maintaining a team is something which can potentially take a lot of effort ([Butler et al., 2002](#)), so this suggests that unless this is an important part of the learning outcomes this effort ought to be minimised if possible. [Pasin and Giroux \(2011\)](#) found in a review of the impacts of simulations in a business management setting, players/students can get frustrated by “team management problems” of e.g. free-riding/“social-loading” (where someone does not pull their weight), disagreements etc.

player has spent with that character. It does not necessarily denote experience, as this may be a player’s second or third character, but often a player’s character’s abilities are limited by the level they are at.

Pasin and Giroux (2011) examined three different kinds of outcome from simulation games: cognitive-based outcomes (how much knowledge has been gained), skills-based outcomes (improvement in desired skills) and affective outcomes (the changes in attitude or motivation). Although the cognitive-based outcomes were found to be similar to other modes of learning, skills-based and affective outcomes were both better for simulation-based learning. However, Anderson (2005) suggests that the cohesion of the teams has a positive effect on the way that the students feel about the process of the game, but a negative effect on their performance in the game. This is a slightly surprising result, but this may be that having teammates that are perceived as less similar to oneself provides an impetus to “prove” oneself and perform better, as opposed to being comfortable with one’s position in the group (King et al., 2009). Increased cohesion can also start to cause a phenomenon known as “groupthink”, where group members do not challenge the group ideas to avoid “rocking the boat”, and this can make the group less effective (Janis, 1982). Also, although diversity in workgroups has been shown to initially reduce the team cohesion, time acts to reduce this effect as the team members form a new, shared, group identity (King et al., 2009).

The Green Revolution Game

The *Green Revolution Game* (GRG) was the first in a series of simulation games written by Chapman and Dowler (1982). It was written to educate policy makers in the day-to-day difficulties faced by subsistence-level rice farmers in the Bihar region of India. This game was produced at the time that new breeds of rice, so called “high yield” strains, were being introduced in India with a great deal of success in the more productive areas. Yet policy makers were finding that take up in the more marginal areas was slower, and they persisted in using so-called “local” rice, which had been grown in the area for generations and had evolved for the local conditions. This game was written to try to help policy makers understand and accept that this reticence may be justified (Chambers, 1981).

Players form a small village, with several players in each “family” or team. These groups are responsible for a number of adults and children, and each are provided with a set number of fields at the start of the game. The game provides only two crops: local rice and high yield rice. The local rice can be saved to sow again the following year, whereas the high yield rice will not yield well if replanted. The high yield rice also needs a good supply of water (in the game this means building irrigation) and fertiliser in order to produce decent crops, whereas the local rice will produce something even in a bad year.

The yield values and family sizes were based on actual figures for the region, although in order to keep the game playable the farm sizes were made larger than normal. The price for rice at the market varies depending on the amount that the village produces. If the families fail to produce enough rice to feed their family they will find that some of their family members will die.

The game does not provide a goal – it is up to the players to decide what they wish to achieve. The desired learning outcome is predominantly for players to experience making decisions with incomplete information and uncertain outcomes, with the high stakes of the lives of family members. Graham Chapman says in the handbook for the game that the decisions are “too tough to be faced alone”, and calls for players to be in groups for mutual support. However, there is nothing in the rules to enforce groups – in fact, the game would work just as well with individual players in charge of each family.

The game was produced by a company based in Cambridge, United Kingdom. The game has been used with policy makers and students in International Development Studies. [Park et al. \(1995\)](#) used the game with students at the University of Tennessee, and they found that students “get into” the game and although they say the game would not take the place of more traditional teaching methods it was overall a positive experience. However, in spite of the positive feedback from players, the price of production was high and the company went out of business. The game is no longer available.

Africulture

Africulture was written by [Chapman et al. \(1993\)](#). In this game the players form a subsistence-level farming community in Sub-Saharan Africa. Rather than only being written to explore the farming choices made by the group, this simulation game focusses as much on the relationships between household members, and how that affects the decisions made.

The players again form a small village. Each player is given a role to play: man, woman or child. The “child” role is actually in charge of a number of non-playing child roles. None of the roles relate to the attributes of the players themselves, and are instead randomly assigned. Each role has different restrictions and abilities, as dictated by the cultural norms in Sub-Saharan Africa at the time of the game’s writing.

The first act in the game is for the players to form into families, with the male characters requiring women to feed them and women requiring the male characters for access to fields to farm. The game has a series of farming tasks which must be performed by players of

a given role, such as clearing land (men), planting food crops (women/children), weeding (women/children) etc. or household tasks such as childcare (women/children), gathering firewood (women/children) and so on. In addition to these tasks in and around the village, the game provides a simple “town” implementation, which is usually positioned in a different room. Players can move between the village and the town at set times when “the bus” is available. The town provides a second option for income, but not all trips to the town are profitable.

The agricultural model in *Africulture* is different from that in *GRG*: there are more crops available including the cash crop of cotton, but there is less detail in terms of fertiliser and pesticide, using a generic addition of “inputs” instead. The increase in crop choices helps to support a more complicated nutritional model. There is a great deal of complexity for the players to absorb. In this game there is no “family” goal, although there are goals for the different roles: male characters are judged on the financial position of their families, those playing women and children are judged on how many children they can keep alive and get through school. The desired learning outcomes of the game are again to highlight the making of decisions with incomplete information, but also to make obvious the differences in the experiences between men, women and children and how that drives the relationships within the families. This game has also been used in educational settings.

2.3 Small Group Development

Groups feature in a massive number of areas in our lives, from the family groups we live in to task-specific work groups. Primarily in games we are talking about small groups, which form a specific area of research.

[Tuckman and Jensen \(1977\)](#) produced a pivotal review of the research on the life cycle of small groups. It concluded that small groups go through a series of five stages, which were labeled as forming, storming, norming, performing and adjourning:

Forming: The group is established. This includes establishing of group roles and interpersonal and task-related behavioural boundaries.

Storming: This is a period of internal group conflict, while the group negotiates their different understandings of how they should interact and form shared norms.

Norming: According to Tuckman, this is the stage where a team ‘develops cohesion’. The roles and norms of the group are established, and members now work to perpetuate

the group.

Performing: The group structure is now stable, and group energy can be channelled into performing the tasks that are required of them.

Adjourning: This stage was added in the second revision of the model in 1977. This reflects that the end of the group is also an important stage in the lifecycle of the group. Sometimes this stage is also referred to as mourning, particularly in business literature.

This model has become widely used, although it has some limitations particularly in the types of groups studied at the time of the review. There was a comparative dearth of industrial examples of small groups, and therapy groups were over-represented. Neither the mechanisms for moving through these stages nor the factors that affected the speed of transition were considered ([Bonebright, 2010](#)).

In contrast to [Tuckman and Jensen \(1977\)](#), [Gersick \(1988\)](#) found that rather than a set series of stages, small groups appeared to go through a series of what she called ‘phases’, punctuated by distinct transition points. The teams involved in this study were task-based, working to solve a specified problem within a given time-frame. However, this is not a structure that is often seen within games, where teams are not given a problem to work through over a period of time and eventually present a solution, but must continually react to the game environment. Teams in games are more similar to what [Wenger \(1999\)](#) describes as ‘communities of practice’, where groups constantly rework what they know and do to meet new (but similar) situations. [Wenger \(1999\)](#) defines a community of practice as having three key elements: mutual engagement (the members of the group are able to interact to mutually define and refine understandings), joint enterprise (e.g. a negotiated and shared aim) and a shared repertoire (shared understandings and acts, including routines, words, tools, gestures etc.). Teams within games meet all three of these requirements, with a mutual engagement organised around the demands of the game, joint enterprise in meeting the game goals, and a shared repertoire of language, actions, and so on. Wenger refers to these three elements as ‘creating coherence’ in the community of practice.

This concept of group cohesion appears throughout small group research. This concept of group or team cohesion, coherence or cohesiveness therefore needs to be more closely examined, as it has a long history of use ([Hogg and Abrams, 1988](#)).

2.4 Team Cohesion

Team or group cohesion has been defined and operationalised in a series of different ways in both sociology and social psychology. For example, [Zander \(1979\)](#) found that cohesion was defined as the desire of members to stay as members of the group or the attractiveness of the group for its members, and based on interpersonal attraction between group members or the group performance, or both. [Kellerman \(1981\)](#) in his review found that interpersonal attraction had been shown to have limited influence on group cohesion, and that “social attraction” – attraction to the group itself rather than the individuals – was a much stronger influence. [Hartman \(1981\)](#) included in his definition “the psychological state which enables a collation of people to experience a unity of feeling and purpose and to work in harmony toward a common goal”.

Given the number of different definitions of cohesion and understanding of what cohesion might relate to, it is useful to look for a definition in light of what can actually be affected by the game designer. A game designer can only affect the game, not choose the players who play the game, or select (other than in the loosest sense) the group structures and dynamics that occur within the playing of the game. Although the introduction of different player classes may result in a particular structure being more successful than others for specific playing instances, the actual decision-making structures and processes have been shown to vary wildly in spite of this attempt at structural control ([Williams et al., 2006](#)).

The design of the game has been shown to be linked to social interactions in online games. In an abstract way, [Kirman et al. \(2011\)](#) demonstrated that a social network analysis of interactions produced a different “scaling” exponent for each different game design. In more concrete terms, [Yee \(2009\)](#) describes the differences in social interactions caused by the death mechanics in *EverQuest* as opposed to *World of Warcraft*, claiming that the perceived higher price of death in *EverQuest* created a greater level of trust and altruism in the players than seen in *World of Warcraft*. Similarly, [Juul \(2005\)](#) suggests that the greater level of team behaviour seen in *Counter-Strike* as opposed to *Quake III Arena* can be traced to differences in rules around respawn points (points where one’s avatar regenerates after dying in-game) and vulnerability of avatar, meaning that in *Counter-Strike* it is more important to have a group covering one’s back! In sports, [Terry et al. \(2000\)](#) noted that there was a significant difference in cohesion reported between different sports, although it is not clear whether this is a factor of the rules of the sport or of the people who were attracted to play the sport.

It is therefore most useful to look at theories that relate the group environment (which can be controlled by the game designer) to the average level of team cohesion, rather than theories that deal predominantly with in-group relationships (which cannot).

2.4.1 Social Identity Theory

Social Identity Theory (SIT) grew out of the research of social psychologist Henri Tajfel in the 1970s, stemming from his interest in inter-group discrimination, prejudice and conflict (Hogg, 2006). The theory considers the relationship between self and group identities, suggesting that our perceived group memberships have an effect on our personal identity, and in turn alter the way we interact with others. The members of the out-group (those recognised as not belonging to the same group as the individual) become stereotyped, but so also does the perception of self, becoming stereotyped as a “good” in-group member. The categorisation of self as part of a group leads to the individual perceiving the other group members as more similar to them, leading to a higher level of in-group identification (Turner, 1999). The more strongly individuals categorise themselves as a member of the group, the greater the in-group identification. In-group identification is therefore used as a measure of group cohesion and the two terms are used interchangeably throughout this thesis.

SIT has been shown to explain in-group identification with naturally forming groups (Tajfel and Turner, 1979, Spears et al., 1999), but also with groups formed using what is known as the “minimal group paradigm”. The groups in these experiments were formed using very limited criteria which were also often trivial and arbitrary, e.g. Group A, Group B, and the participants were isolated from one another. The participants were then asked to distribute rewards between a list of people, with the only information about those individuals being the arbitrary group they were assigned to. Participants demonstrated in-group favouritism, giving greater rewards to members of the same group as them (Tajfel and Turner, 1979). Within a gaming context, Kirman (2013) showed that a similar effect of in-group favouritism or bias appears when players in an online game that requires gift giving were assigned to an arbitrary group with no way other than gift-giving to communicate (although they were allowed to give gifts to any other player in the game, not only those in the same arbitrary group). This result was in line with the minimal group experiments in SIT as described above.

Salience of identity and deindividuation

Each person has a multitude of different social identities that they can call on in different situations. Only one identity can be salient at any given moment, and which identity that is depends on a variety of environmental triggers (Oakes, 1987). It has been suggested that in some group settings this assumption of the group identity can subsume the person's individual personality and lead them to perform acts that fall within group norms, but which they would normally shy away from. This state is called "deindividuation" (Reicher et al., 1995).

People take many cues about how to behave from their environment. Given this, it may be expected that computer-mediated communication (CMC) would increase the salience of the individual identity, as the lack of social cues available in the online environment would surely result in a lower awareness of group membership. However, Reicher et al. (1995) found that in certain circumstances, CMC actually increased the salience of group membership. They conducted a study where a group of students participated in an online discussion, manipulating the anonymity of the individual by either having the participants in separate rooms (deindividuated), or able to see one another in the same room (individuated). They also manipulated group awareness by either referring to the participant as an individual or in terms of their group (in this case the group was "psychology student"). They measured the adherence of the participants to the group norms in a discussion on attitudes to vivisection, and found that the highest level of adherence was in the deindividuated group condition. The lowest adherence to norms was in the deindividuated individual condition, with no significant difference found between the two individuated conditions. This has been interpreted as suggesting that in deindividuated conditions, individuals need to rely more heavily on group memberships to relate to others, as there are fewer "clues" available to help them distinguish group membership (Spears et al., 1990).

Permeability of boundaries

In a given group situation it may be possible to leave that group behind and move to a more satisfactory group. In other situations that is not possible. The group boundaries are impermeable, keeping the individual within a group that is less desirable. This permeability of boundaries has been found to affect the in-group identification of group members (Ellemers, 1993). If the boundaries are permeable, members of low status groups show reduced in-group identification compared to those in low status groups with impermeable

boundaries. This has been attributed to group members' belief that membership in a "better" group is possible, and therefore identifying with their current, low-status group less. Interestingly, in high status groups making the boundaries permeable has been shown to slightly increase in-group identification. [Ellemers \(1993\)](#) suggests that this is due to group members being aware of the possibility of "slipping down" into a less desirable group, making their current group membership look like a very desirable thing!

Group assignment

There are a number of studies looking at group assignment. Choosing one's group rather than being assigned to the group either arbitrarily or by some kind of criteria has a large effect on the way an individual perceives the group, particularly if the group is not a high-performing group. [Ellemers et al. \(1999\)](#) varied three factors of group settings based (ostensibly) on the participants problem solving style: the size of the group (majority/minority), the status of the group (high/low performing) and the selection process for the group (self-selected/assigned). They found that when participants could choose their own grouping they indicated a high level of commitment to the group even if that group was manipulated to have a low status in comparison to the out-group. Again, members of high status groups tended to have a high level of commitment regardless of the selection process.

2.4.2 Prior Association

Players may come into a game already knowing one another to a degree. There are two ways in which this may affect the cohesion of any groups formed: by affecting the duration of the group, and by potentially creating sub-groups within game teams.

One factor that is shown to have a large effect on group cohesion is the length of time that the groups have to work together. [Harrison et al. \(1998\)](#) found that over time, "surface-level" differences between group members (differences such as sex or ethnicity, which are readily discernible) became significantly less important than "deep-level" differences (e.g. differences in attitudes, beliefs and values). The more obviously diverse groups, in fact, functioned better ultimately than those groups that initially appeared homogeneous. In [King et al. \(2009\)](#)'s review on conflict and cooperation in diverse workgroups, they note that several studies found that the longevity of the group reduced the effects of team diversity.

Groups in most board games exist for the same length of time, with all groups starting

and ending play at the same time. Within the context of a group that forms within a game, therefore, the players can only have a longer association if they already knew one another before the game begins. Obviously the number of players who know each other in a given team is not something that a game designer can control. Given the research stating that a longer association will help to create greater team cohesion, a plausible hypothesis is therefore that players who say they knew everyone within their team will report a higher team cohesion than players who do not.

This may also have an effect on the group cohesion if only some of the group members knew each other before the game began, with the potential for a sub-group to form to the detriment of the overall group cohesion ([Ashforth and Mael, 1989](#)).

2.5 Team Member Satisfaction

Although one might suppose that high team cohesion would be synonymous with an individual being satisfied with their group, this is not always the case. There is evidence that group members are not unaware of their group's social situation, even whilst they feel strongly a part of that group ([Spears et al., 1999](#)). [Zavalloni \(1973\)](#) found that participants were able to ascribe negative attributes to a group whilst identifying as part of that group. Obvious examples of this may include supporters of some of the lower-ranked teams in the football league.

[Savicki et al. \(1996a\)](#) found that the all-female groups reported a higher level of satisfaction with their group than either the all-male or mixed groups when performing group tasks (resolving a series of moral dilemmas) using computer-mediated communication (CMC), although the definition of group satisfaction used was not stated in the paper. [Anderson and Martin \(1995\)](#) state that there are a number of different meanings for satisfaction. [Keyton \(1991\)](#) carried out a review of the previous research and found little consensus on the definition of group satisfaction in the literature, although some common factors were identified: status consensus or establishing of an agreed hierarchy within the group, perceived progress towards the group goal, and fairness in participation. [Olaniran \(1996\)](#) added ease of communication to this list of factors, particularly for CMC versus face-to-face communication. [Keyton \(1991\)](#) also identified what she referred to as a “situational” aspect to group satisfaction, suggesting that different factors may impact on the satisfaction of the group depending on the length of history of the group and the potential for further interaction. In this thesis the term “team member satisfaction” has been used to refer to the pleasure and pride reported by the individual in their group membership.

Not all of the factors found in the literature are relevant to the games used within this thesis. In these studies the players started out as peers and there was nothing in these games that specifically modified the status of the players within their teams. Therefore status consensus has not been examined. Also, the situational aspect of group satisfaction has been ignored, as all groups within the games were in the same situation.

2.5.1 Conflict Between Player and Group Goals

Perceived progress towards the group goal would appear to be relevant, but none of the games do more than hint at a group goal, leaving it instead to the players to decide upon. Progress towards any goal is also difficult to measure until the reflective discussion at the end of the game, where the game manager may choose to use criteria for comparison between teams to draw out reflection on particular aspects of gameplay. For these reasons the perceived conflict between the outcomes for the player as opposed to the outcome for the group (mixed-motive) were examined.

2.5.2 Fairness

Fairness in participation and outcome were included by both [Keyton \(1991\)](#) and [Olaniran \(1996\)](#) – were all team-members involved in decision-making, and were the decisions fair to all team-members? Group members may not all put in the same level of effort – “social loafing” occurs when a member of a team displays a reduced effort as compared to the effort they could make as an individual ([Karau and Williams, 1993](#)). [Latane et al. \(1979\)](#) call social loafing a “social disease”, with “negative consequences for individuals, social institutions, and societies”. [Karau and Williams \(1993\)](#) performed a meta-analysis of the research which moderated social loafing, and found that social loafing was a robust phenomenon across a variety of cultures and situations. [Stouten et al. \(2006\)](#) examined the effect of unequal contribution in situations of social dilemma, and found that people react both emotionally and retributively in these situations. This suggests that an inequality of effort in a group situation such as that where one group member exhibits social loafing could undermine the team satisfaction. Social loafing also relates to team cohesion, with an increase in cohesion correlating with a lower incidence of social loafing ([Karau and Williams, 1993](#)). This suggests that the feelings of fairness may well also correlate with team cohesion.

2.5.3 Ease of Communication

Ease of communication within groups has been measured in relation to team satisfaction. [Gladstein \(1984\)](#) found that open communication (amongst other measures) was associated with group satisfaction ratings, as well as the performance of the team. [Anderson and Martin \(1995\)](#) measured the effect that communication motives and involvement had on the “satisfaction of group” measures. They found a correlation between the responsiveness of group members and the satisfaction expressed, with greater responsiveness (knowing both what to say and how to say it) associated with greater satisfaction. [Barczak and Wilemon \(2001\)](#) conducted in-depth interviews with 71 members of teams tasked with new product development in technology-based companies, and also found that strong interpersonal communication skills were very important for team member satisfaction (although they note that these needed to be integrated with “a willingness to support others as well as to work towards common goals”). The easier the communication within the group, the higher the satisfaction the group member would be expected to feel with their group membership.

2.6 Personality

Although the personality of the individuals who play a game is not something that a game designer can affect it is still a factor which contributes to the cohesion of teams that form in a given situation. Given that, there appears to have been relatively little research that links group cohesion to personality. This may in part be due to an accusation that is levelled at SIT: by concentrating on the group settings, the individual is lost (e.g. [Huddy, 2001](#)). [van Vianen and De Dreu \(2001\)](#) examined several aspects of personality in team situations and found that mean and minimum levels of extroversion within a team were related to the social cohesion of the group (although they use a slightly different definition of cohesion). This was taken to suggest that groups will be more cohesive if there are no team members who are highly introverted.

[Anderson \(2005\)](#) examined both team interdependence and team cohesion, noting that teams with low interdependence are characterised by team members who work better alone (e.g. introverted). He related both factors to both performance and affect of the team members, and found that cohesive and interdependent teams produced the most positive affect in the group members (although as described in Section 2.2.3 increased cohesion correlated negatively with performance). He did not note any relationship directly between

interdependence and cohesion, however.

Webb (1982) and Webb and Cullian (1983) examined the role of extroversion/introversion on interactions within a learning group. They found mixed results, with one study (Webb, 1982) showing that interaction with the group was predicted by group personality, but the following studies did not show this (Webb and Cullian, 1983). Again, no relationship was made to the cohesion of the groups. Kempa and Ayob (1995) suggest a higher number of off-topic remarks were made by more extroverted members of learning groups, although there was no correlation between extroversion/introversion and on-task talk. They also note that more extroverted pupils appeared to learn less from others during group work, and suggest that this may be because the more extroverted pupils do not listen to others!

Looking more specifically at preference for group work (PGW), again, there is little research relating this to team cohesion. Stark et al. (2007) look at the relationship between PGW and social loafing, and found some evidence for an inverse relationship between the two. However, although social loafing has been shown to be reduced where team cohesion is high (Karau and Williams, 1993) this does not indicate a relationship between team cohesion and PGW. Campion et al. (1993) examined a number of factors that were presumed to relate to group effectiveness and employee satisfaction, and found that PGW only related to satisfaction. However, this is not the definition of satisfaction being examined in this thesis, and does not relate to team cohesion. Shaw et al. (2000) related PGW to group member satisfaction and individual performance, and found that a positive feeling about group work related to a positive satisfaction and performance. They identify PGW as part of the larger Individualism-Collectivism construct⁵. Again, however, this provides no insight into potential relationship between PGW and team cohesion.

2.7 Online/Offline

As noted by Lessig (2006), in an online game the programming of game rules defines the ecosystem or “physics” of the game entirely. This is not the case in an offline or face-to-face game, where even the most comprehensive rule book cannot provide guidance for every situation (Sniderman, 2006). In an offline environment the players themselves negotiate a shared understanding of the rules, something observed in children’s play (Hughes, 2006). Sometimes this can lead to groups misunderstanding the rules of the game, which can dramatically change the way the game is played (Berland et al., 2010). This kind of

⁵This scale relates to feelings about the importance of individual interests as opposed to group pursuits – see e.g. Wagner III, 1995 for a more detailed description of this construct.

misunderstanding is not possible in online environments, which would appear to be a positive for the online environment. Also many games are complex, especially simulation games and war games. New players may need to spend a long time learning the rules and perhaps performing calculations in order to play, creating a barrier to entry that may deter potential players. It may appear preferable to have the computer deal with some of the complexity.

However, there is some suggestion that having some of this complexity absorbed by the computer changes the game and the meaning for the players ([Wallace et al., 2012](#)). Although there is evidence that automation in games does reduce the work load on the players, if it is not carefully designed it can also increase the confusion of the players, who no longer know exactly why something has happened ([Chang, 2012](#)). [Dunnigan \(2000\)](#) complains in the introduction to the 2000 edition of “The Complete Wargames Handbook” that “Manual games kept the designers honest, as the players could see how the game worked and figure out for themselves if they thought the designer’s approach was on target or not. Computer wargames plunged the games inner workings into darkness.” (pp10-11). It seems clear that the physicality of game pieces have affordances which an online environment does not. For example, in the board game Monopoly, the paper money allows for interactions that fall outside the written rules of the game and contribute to the “feel” of a game, whilst an electronic version with a bank programmed to organise all transactions exactly according to the rules will have a very different vibe (for better or worse). In essence, the modality of the game will have an effect on the social architecture of the game, altering the social patterns of play in potentially unexpected ways ([Kirman et al., 2011](#)).

There has been surprisingly little research on the translation of offline games to an online environment. However, there has been research into virtual team formation in either work or educational environments. Work teams can take a variety of forms, from co-located, semi-virtual (some local, some dispersed members) and completely virtual. [Webster and Wong \(2008\)](#) examined group identity across all three types of teams, and found that team members in co-located teams and fully-virtual teams reported similar levels of group identity. However, in semi-virtual teams the co-located members reported a higher level of group identity than those in either of the other types of groups, whilst the remote members reported the lowest level of group identity. Other findings suggest that although “official” communication is easy to manage for virtual teams using the plethora of tools available (e.g. video conferencing, e-mail etc.), the “corridor conversations” that

help to build team relationships and facilitate the generation of shared understandings are not so easy to replace (Berry, 2011). In general, more practice with the processes involved has been found to reduce the differences between co-located and virtual teams (Berry, 2011, Bull Schaefer and Erskine, 2012, Staggers et al., 2008), and there have been found to be some benefits to virtual teams as well, with members finding it easier to share ideas and to stay on task (Johnson et al., 2002).

This research suggests that there may be some differences in the group processes between face-to-face and online playing environments. Both the change in the social architecture and the differences seen between groups in online and face-to-face contexts in non-game situations suggest that this is an area worth exploring in this thesis.

2.8 Chapter Summary

The research reviewed here provides evidence from a wide number of areas that groups are extremely important in games, and suggests that it may be possible to manipulate the team cohesion reported by players of a game by altering the rules of that game in line with Social Identity Theory. A review of the literature on team member satisfaction suggests that it is still unclear what the nature of the relationship between this and team cohesion will be. The research suggests that factors relating to the individuals playing the games will also affect the team cohesion reported, and the studies must be designed in such a way to reduce the effect of this on the outcome or at least recognise any effects that cannot be controlled. The experimental procedure designed to achieve this is described in the following chapter.

Chapter 3

Experimental Procedure

3.1 Introduction

In order to answer the research questions outlined in Chapter 1, a series of quasi-experimental studies were designed. This chapter will explore the detail of the study design, including an overview of the games and the development of the survey instrument used, with an analysis of the reliability of the measure. The participants of all four studies will be described, along with the procedure followed.

3.2 Study Design

There are two independent variables that will be manipulated in these studies: the social model formed by the game rules, and the game environment (e.g. online or tabletop). A set of four studies have therefore been conducted. Two studies used pre-existing tabletop games. The other two studies were conducted using two versions of an online game written during the course of this work. The social model formed by the game rules varied between games in the same condition – the two online games have been designed as far as possible to have the same differences as the two tabletop games.

The dependent variables are the value of team cohesion and the team member satisfaction. A self-report measure has been used for these. The development of the questionnaire for measuring these variables is described in the following section, along with an overview of the games.

3.3 Materials

3.3.1 Games

All four games are based on subsistence farming in marginal areas, where marginal farmland is defined as having serious limitations which lead to greater uncertainty in the outcome of farming activities. The games all work on an annual cycle that is divided into four seasons. All of the games require groups of 12-36 players to work in small teams to produce enough to feed a family unit which consists of a mix of adults and children and combine to make up a small village. Each game session is run by a “game manager”, who helps to keep the players on track and moves the players through the seasons. The game manager is not connected to any of the families in the game and “plays God”. The game manager role may be taken on by a group, rather than a single person due to the demands of running the games.

The four games are used as teaching tools, where the situations that the players can find themselves in and the decisions faced are designed to relate back to real life scenarios. The learning is generally guided by an expert, who helps players examine the decisions made and expose similarities and differences between their reasoning and outcomes and those experienced by real farmers. The games are designed as open-ended simulations, and the rulebooks emphasise allowing the players to explore the rules rather than having them laid out at the start. They are encouraged to use any relevant domain knowledge they may have — indeed, the target audience for the games is students of international development and policy makers who are expected to have some prior knowledge. Although the annual cycle of the games allows for some in-game reflection at the end of each year, the learning is primarily driven by a full-group discussion at the end of the game. This allows the outcomes for multiple groups to be compared, often drawing out further learning as a result.

Two tabletop games were used. *The Green Revolution Game* (GRG) was written by [Chapman and Dowler \(1982\)](#). The game was based in the Bihar region of India, and has a detailed farming model with fertilizer, pesticide, seasonal planting, irrigation and so on. However, it features only two crops: local rice and high yield rice. The second game is called *Africulture* ([Chapman et al., 1993](#)). This game is based in a fictionalised location in sub-Saharan Africa. This game presents a simpler agricultural model using generic ‘inputs’, choosing to emphasise the gender roles of the family members more than the intricacies of farming. Whilst the farming model is simplified compared to that in *GRG*, this game has a total of six possible crops for the players to choose between. The

social model formed by the game rules is different in the two games, primarily as a result of the focus on gender roles in *Africulture*. Further detail on both of these games will be provided in Chapter 4.

The online game used was *The African Farmer Game* (AFG). This game was designed and built based broadly on the two tabletop games. It uses the more detailed agricultural model of *GRG*, but because the computer is used to perform the complicated calculations required of the players and game manager in the tabletop games, *AFG* supports 6 crops. It also has a more detailed nutritional model than either of the tabletop games. Two versions of the game were written, with differences in the social model that mimic those found in the two tabletop games. One version therefore has a social model that matches that of *GRG*, whilst the other matches *Africulture*. Again, further detail on the design of *AFG* will be provided in Chapter 5.

The four games are similar but not identical in purpose or design. Whilst it is recognised that every aspect of the game contributes to the social architecture for that game (Kirman et al., 2011), it was not possible to use more similar games. The risk of taking an existing game and tweaking only some of the rules is that it may render the game unworkable, and as discussed in Section 3.4 the only reward offered to the participants was the game experience itself. Likewise the project to build *AFG* could not be altered to directly build an online version of one of the two tabletop games due to the external requirements of the project sponsors.

3.3.2 Questionnaire

The main aim of the questionnaire was to report a measure of the two dependent factors: team cohesion and team member satisfaction. The team member satisfaction was further broken down into three contributing factors, as described in Section 2.5. These were (1) conflict between player goal and team goal, (2) intra-team communication, and (3) fairness. Each factor was represented by a number of statements, some of which were worded so that agreeing with them indicated stronger cohesion/satisfaction (positive valence) and some the opposite (negative valence). The players were asked to indicate how strongly they agreed with the statement, selecting from seven answers ranging from ‘Strongly agree’ to ‘Strongly disagree’. Scores for each answer were calculated by translating each Likert scale point to a number (one for ‘Strongly disagree’ to seven for ‘Strongly agree’). The negative valence questions had their score reversed by subtracting from eight. The relevant scores for each factor were then summed to create the single score for that factor. The maximum

scores for each factor were: team cohesion 70, team member satisfaction 98 (of which mixed motive = 49, communication = 35 and fairness = 14).

The questionnaire was initially put through a process of expert review with members of the Sussex Human-Centered Technology lab group, to confirm the consistency of the language and ensure that the sentences were being interpreted in the anticipated way. The group were presented with the theory behind the questionnaire before being asked to read the questionnaire and highlight areas of inconsistency. There followed a group discussion, which confirmed the meaning behind the statements and highlighted statements which were felt to be particularly problematic. The questionnaire was rewritten taking this feedback into consideration.

A small trial was then conducted using a different cooperative board-game (Reiner Knizia’s *The Lord of the Rings*) to test the length of the questionnaire and practice processing the results. This game was used as a trial as it had a shorter duration and required fewer players than any of the games used within these studies. The players play as a single team against the board itself, with each player represented by one of the hobbits from “The Lord of the Rings” trilogy (Tolkien, 1954) plus one extra, and each hobbit has a particular “skill” within the game.

The trial had five participants (four female, one male) who were aged between 30 and 49, with a mean age of 37.2 years. Figure 3.1 shows the group in the middle of the game. The players all knew one another prior to the game. They played for approximate 1.5 hours, with cake and tea provided throughout. After the game finished¹ the players each completed a questionnaire, and once done were asked for feedback on the statements within the questionnaire. The questionnaires were then analysed y processing the results into an appropriate format for statistical analysis (including reversing the Likert Scales as appropriate for the valance of the question) to check for any problems with the questionnaire from the processing perspective. There was insufficient time and sample size to perform a full factor analysis of the questionnaire at this point, but a calculation of the Cronbach’s Alpha was made in an attempt to highlight any major issues in the reliability of the questionnaire and none were found.

Final changes in the layout and numbering of the questions were then made before the first of the four studies were conducted. This final version was used with no further changes other than the study reference number for all four of the studies conducted.

The full questionnaire can be seen in Appendix A. The study reference number fea-

¹Sadly, the players lost the game and were eaten by Shelob.

Figure 3.1: A trial run using the Lord of the Rings board game: players mid-game.



turing a shorthand for the game played and the date of the study was included in the header of the questionnaire for ease of later processing and to avoid asking the players to complete more questions than were necessary. The page numbers were included at the bottom to provide a measure of progress and a sense of the length of the questionnaire.

Team Cohesion

Team cohesion (or in-group identification) was measured using ten items. These were based on a pre-existing in-group identification scale (c.f. [Ellemers, 1993](#)), although the questions used in that scale were rewritten as statements to maintain the consistency of the questionnaire. The statements used can be seen in Table 3.1. There are eight questions with a positive valance, and two negative. The statements centre on the cognitive awareness of group membership, as well as some designed to emphasise evaluative and affective components of the group identity.

Team Member Satisfaction

The remaining fourteen items measured group satisfaction. Of these, seven items were designed to measure conflict between player and team goals (see Table 3.2). Four statements were structured so that agreement indicated a closer alignment between the group and the player (positive valence) and three where agreement indicated conflict with the group (negative valence). A higher score indicated a closer alignment between the outcome for the player and the group. These questions were designed to focus on the decisions made by the group and how the decisions and the outcome could have been different if the player had been playing alone.

A further five items looked at the perceived ease of intra-team communication (Table 3.3), focusing on the ability to reach a representative consensus. Two items examined

Question	Valence
I had a lot in common with the other team members	+ve
The team bonded well.	+ve
In view of the way I played the game, I should have been part of a different team.	-ve
I would like to play another game with this team.	+ve
I think I might have preferred to be in a different team.	-ve
I am glad I ended up in this team.	+ve
I am happy with the way the other members in the team played the game.	+ve
I feel my approach to decision-making was well-matched to the team approach.	+ve
I would like to continue being a part of this team.	+ve
I enjoyed being a part of this team.	+ve

Table 3.1: Statements for Team Cohesion measure

perceived fairness of team members' participation (Table 3.4), with one focussing on the fairness of the workload, and the other looking more at the fairness of the outcomes.

Demographic data

In addition to the self-report of team cohesion and team member satisfaction, the players were also asked for their team name and some basic demographic data. This included the gender of the respondent and their age. Two further questions were added to examine areas that may have contributed to the level of team cohesion reported: how much the participant enjoys working in groups, and how many of the team were known to the participants before the game began. The first of these questions related to the preference for group work of the participant (see Section 2.6 for details). This question had three answers: "I work best in groups", "It depends" and "I prefer working alone". The second question explores the duration of groups and whether they extend beyond the length of the game (see Section 2.4.2). The question had five answers, ranging from "I knew no one else" to "I knew everyone else".

Analysis

Across all four studies this survey was completed by 62 participants. Overall, the 24 items of the survey showed a high degree of internal consistency ($\alpha = .88$).

Question	Valence
I was happy that the team made sensible decisions with the information and resources they had available.	+ve
I would have made different decisions playing on my own.	-ve
The team made better decisions than I would have on my own.	+ve
The team achieved the best outcome it could have for the team as a whole.	+ve
I was not as successful as I could have been if the team had made different decisions.	-ve
I was more successful as part of the team than I would have been on my own.	+ve
I feel I would have made better decisions than the team did.	-ve

Table 3.2: Statements for Mixed Motive measure

Question	Valence
Our team had difficulty reaching decisions.	-ve
There were serious breakdowns in communication within the team.	-ve
I felt my opinion was heard and valued even if the decisions the team reached were different.	+ve
Team members were able to express themselves freely and easily.	+ve
It was difficult to communicate with the other members of the team.	-ve

Table 3.3: Statements for Communication measure

The Cronbach's alpha for the ten items of the team cohesion measure was .830. All items in the scale appeared to be worthy of retention: the greatest increase in α would come from removing question 2.3 ('I had a lot in common with the other team members'), but the increase would be only .001. All of the items correlated with the scale to a good degree (lower $r = .40$).

The overall team member satisfaction scale also shows good reliability ($\alpha = 0.792$). The largest increase in Cronbach's alpha would come from removing item 2.24 ('The decisions made didn't favour any particular team member over the duration of the game.'), but the increase to the alpha would again be relatively small at .014. However, this item does display a low correlation value at $r = .157$.

Question	Valence
Some team members didn't participate in the decision-making process.	−ve
The decisions made didn't favour any particular team member over the duration of the game.	+ve

Table 3.4: Statements for Fairness measure

3.4 Participants

Each of the games required between twelve and thirty players. Due in part to the practicability of the situation, different players were used for each of the four studies. However this also fitted the needs of the research questions, which primarily focus on the building of team cohesion and satisfaction through one game. The participants in two studies (*GRG* and *Vanilla AFG*) were attending a summer school for doctoral and post-graduate researchers (or equivalent) at the STEPS Centre². *Africulture* was played by participants who were studying for post-graduate qualifications in a variety of International Development-related programmes at the University of East Anglia. The final study had participants who were again studying for post-graduate qualifications, this time at the Institute of Development Studies. All of the participants shared a high level of education and a background in International Development, and were invited to play the game as an optional educational experience. No financial incentive was given, and no participants received extra credit on any course in return for participating. The games all took place on Sundays. The players did receive free food.

In total, sixty-two participants played in the four game sessions, including 35 female participants and 27 male. The mean age across all four games was 29.9 years³.

3.5 Procedure

Each of the four game sessions consisted of approximately one hour of introduction, three hours of playing time, and concluded with a full-group reflective discussion. Food and drink were provided for the participants and play continued while people were eating. The topics covered in the final reflective discussion included the respective household starting sizes, the strategies they used and why. Players then reflected on the extent to which these strategies worked within the game and how they might have been changed to be more successful. This discussion was led by a subject matter expert who attended the

²see <http://steps-centre.org/about/steps-summer-school/> for further details.

³Five players declined to provide information about their age. This mean is for the remaining 57.

Figure 3.2: This shot taken during an African Farmer Game play session demonstrates a typical room layout.



entire session, participating as part of the game management team.

In order to prevent this period of reflection from altering the players' views of their teams, the questionnaire was administered between the end of the playing period and the reflective discussion. Players were informed as part of the introduction that they would be asked to complete a questionnaire at the end of the playing time, but were not informed of the topic of the research. Although it is possible that the players' preference for working in groups will have been altered by playing the game, it was felt that it was better to leave them to play without having pre-knowledge of the research being conducted.

Each game is driven by a game manager. In three of the four games I performed this role with two assistants helping the players as required. In the Africulture game I was an observer, and the game manager role was performed by a subject matter expert who was more familiar with the complexities of the game.

All four games were played in a large room, with families grouped around shared tables. Figure 3.2 demonstrates a typical room layout, particularly for the online games. Although the online games would have supported players in different locations, this was felt to be a more straightforward approach, better guaranteeing the amount of time the players played for and reducing the potential for slower remote communication in the online setting to affect the outcome of the study (Tidwell and Walther, 2002). It also enabled immediate assistance in cases of technical difficulty. It is recognised that this does make the game more like an electronic table-top game than a fully online experience.

3.6 Ethics

The games used within this series of studies have the potential to be somewhat traumatic experiences depending on the outcomes for the players' families. All four games include the deaths by illness or starvation of family members, and indeed it is likely that these occur. Sometimes players may be required to make difficult decisions. It was the effect of these incidents on the players which was felt to be the greatest ethical concern within the study. The reflective discussion at the end of the game not only allows the participants an opportunity to learn from the game, but also provides a way for the players to 'decompress' somewhat. It provides a buffer between the game and 'real life', and (it is hoped) minimises the after-effects of the game on the players. Participants in the four studies were also all over the age of 18.

Players did not have the full purpose of the study explained to them at the beginning of the game. This was in an attempt to prevent the players from focussing abnormally on their interactions with their groups. They were informed that they would be asked to complete a questionnaire at the end of the game which related to their experiences. The players were also told that completing the questionnaire was entirely optional, and would not affect their participation in the game. Each was provided with an information sheet (see Appendix B) and was asked to sign a consent form for collection and usage of voice, photo and video data where appropriate (see Appendix C for the consent form) before completing the questionnaire.

The collection and storage of demographic data was also identified as a possible ethical consideration. The data collected about an individual was held separately to the consent forms, and there was no way to link the consent forms to the questionnaire responses without further information from the player about the team they were in. It would have been possible to have the data removed from the collection at a later date with this additional input, and the players were made aware of this possibility on the information sheet provided. They were also provided with an email address should they wish to request any further information on the project.

Formal ethical approval was sought and given for this project based on the precautions outlined above.

3.7 Chapter Summary

In this chapter I have described the design, participants and procedure of the four studies performed and the similarities between all four. More detail about the differences will be described in later chapters. The design of the questionnaire that was used across all four studies has been described, and results for the reliability of the questionnaire were presented.

The following chapter describes in more detail the two studies featuring the face-to-face games, and discusses the results of these studies.

Chapter 4

Tabletop Games

4.1 Introduction

In order to answer the key research questions outlined in Chapter 1, two initial studies were carried out in 2012 using pre-existing tabletop games. This chapter describes these studies, comparing the team cohesion and team member satisfaction reported by players. The questionnaire used to gather the values for these factors from the players has been described in more detail in Chapter 3.

The two games used in these studies will be described, highlighting the similarities between the two games and the significant differences. The significance of these differences will be discussed with reference to some of the research into SIT, providing a hypothesis for which game will produce greater team cohesion. The procedure followed for each game is outlined, including details of the participants. The results of these two studies are compared on the details of the team cohesion produced and the team member satisfaction measures. Other factors that could potentially affect these factors are discussed in Chapter 7.

4.2 Games

Two similar games were used in these studies: the *Green Revolution Game* (GRG) (Chapman and Dowler (1982)) and *Africulture* (Chapman et al. (1993)). Both are educational tabletop games designed to simulate subsistence-level farming in rural economies. The aim of these games is to provide students and policy makers with more insight into the complex decision-making processes of small-scale farmers. In both games players are exposed to the difficulties these farmers face in making decisions, often with uncertain and incomplete information, that have literal life or death consequences for their families. The

games are played by between 15-35 players in small teams of two or more. Each team represents a “family” of varying size in a village community. Families must decide what crops to grow and how best to employ their family members and manage their resources in order to keep the family alive. The games both have annual cycles of four seasons each, and all crops are annual crops taking a maximum of four seasons to grow.

The games are run by a game manager, who presents the rules of the game to the players, and oversees gameplay throughout. The game manager’s handbook for both games stresses that although basic rules of behaviour can be provided at the outset, others will arise spontaneously as the game unfolds. In addition to progressing the game through the seasons and announcing various hazards, the game manager also runs the marketplace and bank, deciding whether to issue loans and setting the price for the various items that are available in-game. The game manager role is frequently filled by a small group of people due to the large amount of information to keep track of.

Comparisons between families and players are made only at the end of the game, in a post-game debriefing whose primary purpose is to reflect on the strategies used by each family and, more broadly, to consider the impact of societal, cultural and political factors on subsistence farming in uncertain conditions. The two games are very similar in purpose and execution in that both are team games, where players share resources and make joint decisions. However, there are marked differences between the two games in terms of the way that the both the game goals and the teams are managed.

4.2.1 The Green Revolution Game

In *GRG*, the teams are formed on arrival, often before players have formed a clear idea of how the game is played, and certainly before the assets (fields and family sizes) have been distributed. Players form teams of two or three farmers who do not take on a particular role in the family. The family initially consists of a combination of adults and children and may go on to include babies as the game progresses. These fields and family members are represented by a set of plastic figures (see Figure 4.1) which are shared by the team and are used to show the state of each field and which household member is working where. The players are equipped with paper and pens for rough working, and a set of sheets for calculating the productivity of each field after the weather for the seasons is announced by the game manager.

Once the teams are formed there is no mechanism for changing teams during the game. The team as a whole is judged on the success of their family, but how that success is judged

Figure 4.1: The game pieces for a family in the *Green Revolution Game*.



is not defined in the handbooks. This allows for a degree of flexibility in the game, giving the players the chance to decide on their own measures of success and therefore employ different strategies, or allowing the game manager to highlight a particular area for their participants. However, the game manual does suggest producing final figures for the total wealth of the family as a starting point for comparison. Other potential ways to measure success could include the health of the family, or how many children were educated.

4.2.2 Africulture

In *Africulture*, players are given roles of man, woman or child (unrelated to their actual gender or age) and allocated associated assets before being asked to form teams. Those playing men require women to provide their food, and women and children are advised to find men to augment their assets and provide access to land. Although households with no male characters are possible they are at a distinct disadvantage due to their significantly lower financial allocation at the start of the game. Throughout the game players can negotiate to change households and this happens quite often. The goals of the game are different for the different roles: men are judged by the amount of wealth they generate and women and children are judged on their success in keeping children alive and providing them with an education. However, the over-arching family goal is again left to the family members to decide. As with *GRG*, the differences in the relative success of the players – by whatever measure the game manager wishes to draw out – are only made explicit at the end of the game.

The players have a set of pieces representing the family members and themselves. Each field has a separate sheet, which acts in a similar way to the field pieces in *GRG* and allows

the family to keep track of who is doing the work, which crops they are growing, and how much of each they grow. The game manager ensures that each family has characters responsible for the essential household tasks, distributes the tokens for the grown crops, and removes the food used to feed the family.

In addition to the village area, this game also includes a “town”. This is set up in a physically separate area from the main area, and is looked after by a second game manager. A family may choose to send a family member to the town to seek extra income. This removes at least one team member from the decision-making process for the duration of their stay in town. The actual income is controlled by a random selection, and it is possible to lose money on a trip to town instead of gaining. This leaves the players with further uncertainty in their plans.

4.2.3 Analysis

In order to answer *RQ1: To what extent do the real-world findings from Social Identity Theory translate to game worlds?*, the rules of the two face-to-face games were compared, using SIT to hypothesise which game would produce the greater level of reported team cohesion in the players.

In both games the player is part of a team that is effectively a family. As such, the expectation is that they will work together for the collective good of the family. The differences between games that have been outlined above would appear, on the face of it, to be relatively minor. However, it may be that despite the centrality of the family unit, the rules engender different social models.

Work on Social Identity and Deindividuation ([Reicher et al., 1995](#)) suggests that group membership can be made salient by subtle cues, such as referring to a person in terms of a specific group in task instructions rather than as an individual. *GRG*, with its focus on team performance, reinforces the identity of team member, whereas *Africulture*’s emphasis on individual performance should make individual identity more salient. Emphasising individual performance should increase the view of the rest of the team as competition, and reduce in-group identification. This leads to the hypothesis that team cohesion in *GRG* will be higher than in *Africulture*.

It is generally assumed that people look to associate with positive social identities where possible; choosing to belong to successful groups or teams. If a person finds themselves in a group that is not successful, they may choose to distance themselves from that group in preparation for changing to a more successful group, leading to a lower level of

identification with their current group (Ellemers, 1993). However, it is not always possible to change groups. For example, in South Africa in the apartheid era it would have been impossible to change from black to white. The inability to change groups reduces the impact of a group's low status on in-group identification. Instead of moving on, group members often either redefine their measures of success to make their group look more positive, or try to improve the lot for the group as a whole (Turner, 1999). *GRG* does not allow for changing teams, unlike *Africulture*; it is therefore hypothesised that on average *GRG* players should show a greater level of cohesion, even in unsuccessful teams.

The group formation stage also has an effect on the lowest performing groups. Allowing players to select their group membership rather than being automatically allocated has been shown to increase the commitment to the group when the group performs badly (Ellemers et al., 1999). If the group does well, the group selection mechanism has no effect. In these games, both have an element of self-selection. Although the teams in *GRG* are formed without full knowledge of the game the players still choose the group that they wish to sit with, rather than being randomly allocated to teams. However, in *Africulture* players have better information about the potential strengths and weaknesses of the team when they form it. This may lead to an increase in the team cohesion in *Africulture*, but it may be a weak effect as the differences between the games is less than it could be (e.g. if the teams were randomly assigned in *GRG*) and will be countered by the ability to change groups explored above.

In summation, this analysis lead to the hypothesis that teams in *GRG* would show higher cohesion levels than teams in *Africulture*.

4.3 Method

4.3.1 Participants

In total, 36 participants took part in the two game sessions: 24 female and 12 male. The participants in both games were post-graduate students of International Development and form part of the target audience for these games. There were a wide range of nationalities represented. Prior to starting the game, the participants were given an information sheet providing details of the study and explaining that if they elected to participate in the study they would be asked to complete a questionnaire at the end of the game. The information sheet also made it clear that a player would be able to play the game without taking part in the study.

GRG was offered as an extra-curricular event as part of a summer school. Fifteen players signed up (nine female, six male). These participants were aged between 24 and 47, with a mean age of 31.4 years¹. Twenty students from the School of International Development at a university in the South of England played *Africulture* (fourteen female, six male). The ages of these participants ranged between 21 and 33, with a mean of 26.2². The game session was an optional activity with no impact on their course marks.

4.3.2 Procedure

Both games were played to the rules contained in the respective game manager's handbook. Each game was played for three hours, with food provided for the players to eat whilst the game continued. The paper questionnaire described in Chapter 3 was administered at the end of the playing time, before the post-game discussion could reveal the true positions of the players and teams.

The Green Revolution Game

GRG was played in a single large room. The room was laid out with a series of pre-arranged tables, each of which was prepared as an individual farm with the number of fields allocated. When the players arrived they were invited to seat themselves at any of these tables, with some minimal influence from the researchers to balance the size of the teams. The players were then introduced to the game, and told that the tables they were sitting at would be their teams for the remainder of the game. After that the family sizes and game pieces were allocated, and the significance of the field pieces on the tables was explained.

The bank and market were set up at the back of the room, with a second game manager taking on the role of the banker. The families had to send players to see the banker to buy and sell their crops. The bank and market were only open for limited periods in each season and annual cycle.

The teams completed five annual cycles of four seasons. At the end of the game the players were asked to calculate their total worth based on the final market prices before completing the questionnaire.

¹One player declined to provide their age. This range and mean is calculated for the remaining 14.

²Again, one participant declined to answer this question, so the range and mean are calculated for the remaining 19.

Figure 4.2: The game managers made use of the walls to advertise the market prices in *Africulture*.



Africulture

The game took place within a main classroom (the village) and the corridor outside the room (the town). The village room was laid out with a game manager's area along one side of the main room (see Figure 4.2), with a number of tables arranged to one side of that. Each place in the room was pre-prepared with a game card that explained which role the player sitting in that place would take on. The “men” were positioned at one end of the room, whilst the rest of the room had “women” and “children” as described in the game manager's handbook. These cards were initially placed face down on the tables so that the players did not know which role they would be playing in the game and the gender roles within the game bore no relation to the real-life gender of the player. The players were invited to sit at any of these pre-arranged places, and after an introductory talk were allowed to turn over the cards to reveal their roles and the other resources available to them.

After the resources were revealed the players had to conduct a negotiation to form teams. No limit was placed on the size of the households that formed in this period. It is possible for a family group to survive with no player in the male role, however they are at a considerable disadvantage and no households without a male formed on this occasion. The teams formed with no input from the game managers.

The players played for three hours, and completed three annual cycles of four seasons per cycle in this time. In light of the potential differences in team cohesion caused by the duration of the group (see Section 2.4.2 for further detail) a decision was made to maintain a constant time scale for the game rather than repeat the same number of annual cycles.

	GRG	Africulture
Median	61.00	58.00
Minimum	56.00	49.00
Maximum	70.00	69.00

Table 4.1: Team cohesion scores for the face-to-face games as a function of game played.

	GRG			Africulture		
	Median	Min.	Max.	Median	Min.	Max.
Overall team member satisfaction	82.00	70.00	98.00	73.50	65.00	93.00
Mixed motive	41.00	30.00	49.00	36.00	26.00	46.00
Communication	32.50	25.00	35.00	29.00	21.00	35.00
Fairness	13.00	8.00	14.00	9.00	5.00	14.00

Table 4.2: Team member satisfaction factor scores as a function of face-to-face game played

4.4 Results

4.4.1 Team Cohesion

The scores for team cohesion and team member satisfaction have been calculated as described in Section 3.3.2.

Table 4.1 shows the median and range for the team cohesion measure in each game. *GRG* produced a higher average cohesion value across all players (median=61.00, minimum=56.00, maximum=70.00) than *Africulture* (median=58.00, minimum=49.00, maximum=69.00), a difference which was statistically significant using a one-tailed Mann-Whitney test ($U=103.5$, $p<.05$, $r=.32$). A Mann-Witney test was used because the data produced by the questionnaires is ordinal data, suggesting that non-parametric tests should be used. This test was one-tailed due to the hypothesis made in Section 4.2.3.

4.4.2 Team Member Satisfaction

As shown in table 4.2 there were significant differences (using a two-tailed Mann-Whitney test) between the two games for the overall satisfaction measure ($U=87.00$, $p<.05$, $r=.47$). Of the individual factors making up this measure there are significant differences in communication rating ($U=91.00$, $p<.05$, $r=.28$) and the fairness rating ($U=57.00$, $p<.05$, $r=.18$), with *GRG* showing higher ratings than *Africulture*. The mixed-motive rating showed a similar but non-significant tendency ($U=102.00$, ns).

4.5 Discussion

The results presented in this chapter illustrate the differences in team cohesion and team member satisfaction reported by players at the end of play sessions in two games designed to have different emphasis on the group. Initial analysis comparing the differences in the social rules of the games using social identity theory suggests that of the two games, players of *GRG* should report higher levels of team cohesion than players of *Africulture*, and this was indeed found to be the case. The team member satisfaction ratings were also generally higher in *GRG* than in *Africulture*.

RQ1: To what extent do the real-world findings from Social Identity Theory translate to game worlds? What effect does changing the game rules have on the team cohesion levels reported by the players?

It appears that the conditions found in real world group settings, including group permeability and variation in group formation, can be replicated using game rules. Whilst it is difficult to pinpoint the amount of variance in the team cohesion that was due to the change in the social model alone, the difference between the games was in the direction predicted by an analysis of the rule differences using SIT.

It was interesting to observe the differences in the way that the two games were played. In the *GRG* session, the players were seated in their groups around separate tables, and only really moved from these tables to go to see the banker. The game manager and banker moved around the tables, collecting information on the states of the families and the amount of rice produced, and at these points players would try to glean information about how the other tables were doing. Anecdotally, there appeared to be almost a feeling of competition between “families”, although when one group began to struggle they did manage to find assistance from another, wealthier group (they noted that they felt at a real disadvantage in having to do so). The wealthier group cited potential future payback as their reason for helping – a form of social capital. No members of any team asked if they could swap groups, and although it was never stated whether they could or could not do so.

In *Africulture*, the scene was much more chaotic. Families did have individual tables, but frequently moved around the room and out to the town area, chatting to people from other families or simply spying on their farms. Although the game manager did move from group to group in order to ascertain the amount of food produced and to remove the amount required to feed the families, the players were perceived to be much less interested in the performance of other teams during that visit. In the reflective discussion at the end

of the game it emerged that one female player playing a male role had sold her “wife” to another group partway through the game (her only regret was that she had not sold the children at the same time!). This indicated that in this game, the players had assumed that families were fluid.

RQ2: How does the level of in-group identification reported relate to team member satisfaction?

In these two games the level of team member satisfaction varied in the same direction as the team cohesion (or in-group identification). The overall measure of team satisfaction demonstrated a significant difference between the two games, as did the communication and fairness measures. The measure of conflict between team and individual goals displayed a non-significant tendency in the same direction. The measures all suggest greater satisfaction with the team in the condition where the game rules were designed to emphasise team cohesion.

The lack of significant difference in the perceived conflict between individual and group goals is interesting. In *GRG* the game itself supplies no individual goal, and only vaguely suggests a team goal. *Africulture*, in contrast, supplies a way to evaluate individual progress, but again only hints at a team outcome. The presence of any conflict in team and individual goals must therefore suggest that players come into the game with their own goals, and a) are not always successful in steering the group into adopting their goal as the group goal and b) do not always drop their personal goals in favour of the group goals.

Smith (2006) proposed a “Rational Player Model”, in which players are assumed to have stable and ordered preferences of outcome, and that these are supplied by the game. He suggested that this was the predominant (yet unspoken) model of a player used by game designers. However, he found that whilst players did generally adopt the goals of the game, they did so in ways that were moderated by the “social norms defining appropriate play”, or by modifying their so-called “rational” behaviour to include goals and priorities from outside of the game. This result would appear to be in line with that finding – in a game with no measure of individual performance let alone goal (*GRG*), players still recorded some level of conflict between their desired outcomes and the direction that the team chose to pursue.

4.6 Chapter Summary

This chapter has presented the results from the two studies featuring the face-to-face games. The rules of the two games were compared, with the differences analysed with

respect to SIT and a hypothesis made that *GRG* would produce a higher level of team cohesion on average across all players than *Africulture*. The results from these studies supported that hypothesis, and showed a corresponding higher level of team member satisfaction.

The next chapter will explore the design of the online game that was used to replicate these two studies in the online environment. The initial design requirements for this game will be discussed, followed by the design of the game that resulted from those requirements.

Chapter 5

The African Farmer Game: Design, Implementation and System Description

5.1 Introduction

Within this chapter the design and implementation of the *African Farmer Game* is discussed. This game was used for subsequent studies which will be described in Chapter 6, and was written as part of a project for the Future Agricultures Consortium. A description of the background and initial requirements for the *African Farmer Game* is given, followed by a detailed overview of the system designed to meet these requirements. This system overview will be broken down into the technical design of the system, the game play design and the design of the user interface which supports the game play. The reaction of the players to the game produced will be related back to the requirements.

5.1.1 Background

The *African Farmer Game* is a multi-player simulation game, situated in a rural farming community in an undefined part of Sub-Saharan Africa. Players take on the role of farmers and must make decisions about the crops they need to grow to keep their families alive. The game was designed to be used in an educational setting. It was commissioned by the Future Agricultures Consortium¹, an African-based alliance of research organisations who work within agricultural policy and practice in Africa. Members of this group have previous experience of using paper-based simulations to help educate both policy makers

¹<http://www.future-agricultures.org/>

and students of international development. Two games in particular were used as the basis for the *African Farmer Game: The Green Revolution Game* (Chapman and Dowler (1982)) (GRG) and *Africulture* (Chapman et al. (1993)). These games have been described in more detail in Chapter 4 (Section 4.2). Both are tabletop games, allowing the players to take on the roles of the people they are working with and so increase their empathy and understanding for these people and the decisions they make.

These games have a successful record with the people who have used them (e.g. Park et al. (1995), Fox et al. (2007)), but there are a number of barriers that prevent these games being more widely used. The games require a group of 16-35 people to play (not including the game managers) and the participants will need to be able to give up an entire day to really immerse themselves in the play. This can make scheduling the game difficult in two ways: there may not be a sufficient number of people to play in some locations and even where there are it can be difficult to persuade people to find a full day, especially ‘just’ to play a game. Also, in order to run a game like this someone needs to perform the role of game manager. This is a very taxing role, dealing with a complex set of rules during both set up and gameplay, and performing quite complex manual calculations throughout. These are very daunting games to attempt to run and often the role is split between two or more people. In addition to these issues (or perhaps as a result of them), the volume of sales was so low that the game sets remained extremely expensive to buy, and GRG is not in production at this time. It was felt that an online game would help to overcome some of these issues, by enabling participants to be more geographically spread, reducing the load on the game manager, potentially reducing the cost of deployment, and enabling a more flexible schedule for the game.

The work on this project was completed in collaboration with James Jackson and Judith Good. Together we gathered the requirements for the game and designed the game flow and interface. James then took on a predominantly design-oriented role and managed the communication with Future Agricultures while I completed the programming. I designed and wrote the server-side code entirely. James designed the front end by working on a standalone prototype/demo system, and I then pulled those visual elements into a separate, server-driven version. Throughout the process as further feedback and information was gathered and more questions arose James and I continued to work together and consult on the best solutions available to us. James has also produced a single-player version of the game from the initial prototype, with the aim of further reducing the barriers to entry by allowing people to sample the game before playing with a group. Judith Good

helped to manage the project.

5.2 Requirements

The requirements gathering process for this project started with an initial round of meetings with subject matter experts (SMEs) who were predominantly experts in the domain to be simulated but also teachers who could potentially use the system. Some of these SMEs had also designed simulations in the past. We undertook a detailed analysis of the two existing games and their rules. Once some initial ideas had been formed a PowerPoint prototype was produced that could be used as a “straw man” in a further round of SME meetings. Having a concrete prototype helped to guide these discussions and keep them more focused than the initial abstract discussions. As the project continued the prototype was re-written in Adobe Flash to demonstrate the kind of interactions we were hoping to achieve without needing to implement the full multi-player functionality. We continued to use this prototype to seek feedback from a range of sources, including students of HCI, throughout the development process.

Through this ongoing process of research, consultation and refinement, we found that there are three kinds of requirements for this game: pedagogical, user and technical. These shall be considered separately.

5.2.1 Pedagogical requirements

The game is intended for use in an educational setting, and as such there are some key elements that need to be represented and issues that must be addressed.

The primary aim of the game is for the players to gain a better understanding of the level of complexity faced by small-scale farmers in Sub-Saharan Africa when making decisions. The players therefore need to face simplified versions of these decisions: balancing the choice of crop, available land and labour with the amount of income they have and the need to feed their family. The outcomes for any choice made must be sufficiently uncertain that the players need to deliberate over them, and, as in life, there should not be any clear “winning” strategy. Indeed, the players ought to be able to define their own goals and measures of success, as this will affect their strategies. Making the most money is an obvious goal, but improving the diet of the family, or increasing their social capital are also valid and will change the approach taken by the players. These requirements are similar to those suggested by Graham Chapman in the Game Manager Handbooks for both *GRG* and *Africulture*.

Discussions with SMEs highlighted that the aim of the system is not to teach the agricultural or nutritional detail, only to provide a coherent world that allows the players sufficient (and sufficiently realistic) choice and understanding of risks without overwhelming them. Crops, yields, pests and so on are extremely location-dependent, and teaching these details would not be widely useful.

The players must be able to participate fully in the game, but without the potential for family deaths the game would not accurately represent the situation in a rural African community. Ideally the game should be balanced so that a range of outcomes is represented within a group of players, from some growing rich to some on the verge of extinction. This may not be a comfortable experience. However, experience from *GRG* and *Africulture* suggests that this is a good way to bring insight into the behaviour that being in this situation may cause.

5.2.2 User requirements

There are two sets of user requirements - those for the players, and those for the game managers.

The players need to be able to keep track of their assets, the health of their family members, and all of the farming elements. Information availability will ideally mimic that of real-life farmers where possible. This may include basic information about their neighbours, but the players should not be omniscient. The information for a family needs to be kept current for all family members without the players needing to physically update the user interface.

At the most basic level, the game manager needs a way to set up new games and manage them effectively. This includes being able to move the game forward at the pace that they choose. The current boardgames allow the game manager to control the pace of play, and the online games need to replicate this. The game manager needs to be kept abreast of the situation of each family, particularly when players are in difficulty. This information needs to be presented clearly – there is potential for too much detail to cloud the overall patterns.

If players are struggling, the game manager needs to be aware of this and have ways to help. This is to allow the players to stay in the game for the duration. Within the existing games there are various ways to meet this requirement, from the game manager supplying extra goods or money, through to the game manager being able to resurrect players (although this clearly is not very life-like!). One way that was observed during a

game of Africulture was for the game manager to alert the rest of the village to the plight of a family, asking the other players if they could help rather than relying on external aid. Ideally therefore the online game should also enable the game manager to be flexible in their response to game events.

The game interface should facilitate communication between players, both between family members and between families. This is crucial to meet the requirement for players to be geographically separate. Communication between game manager and players should also be supported. The game manager should have a way to broadcast information to all players, or be able to communicate with individual players. Ideally the communication methods should mimic communication methods found in Sub-Saharan Africa, for consistency. For example, the use of mobile phones is wide-spread and sophisticated, email perhaps less so.

5.2.3 Technical requirements

The game should be multi-player, which will require a client-server solution. The client software needs to run on as wide a variety of machines as possible (e.g. desktop PCs, laptops, notebooks) and operating systems both old and new. This will allow people to participate without needing the latest hardware. It should not be network-intensive, allowing players on low-bandwidth connections to participate successfully.

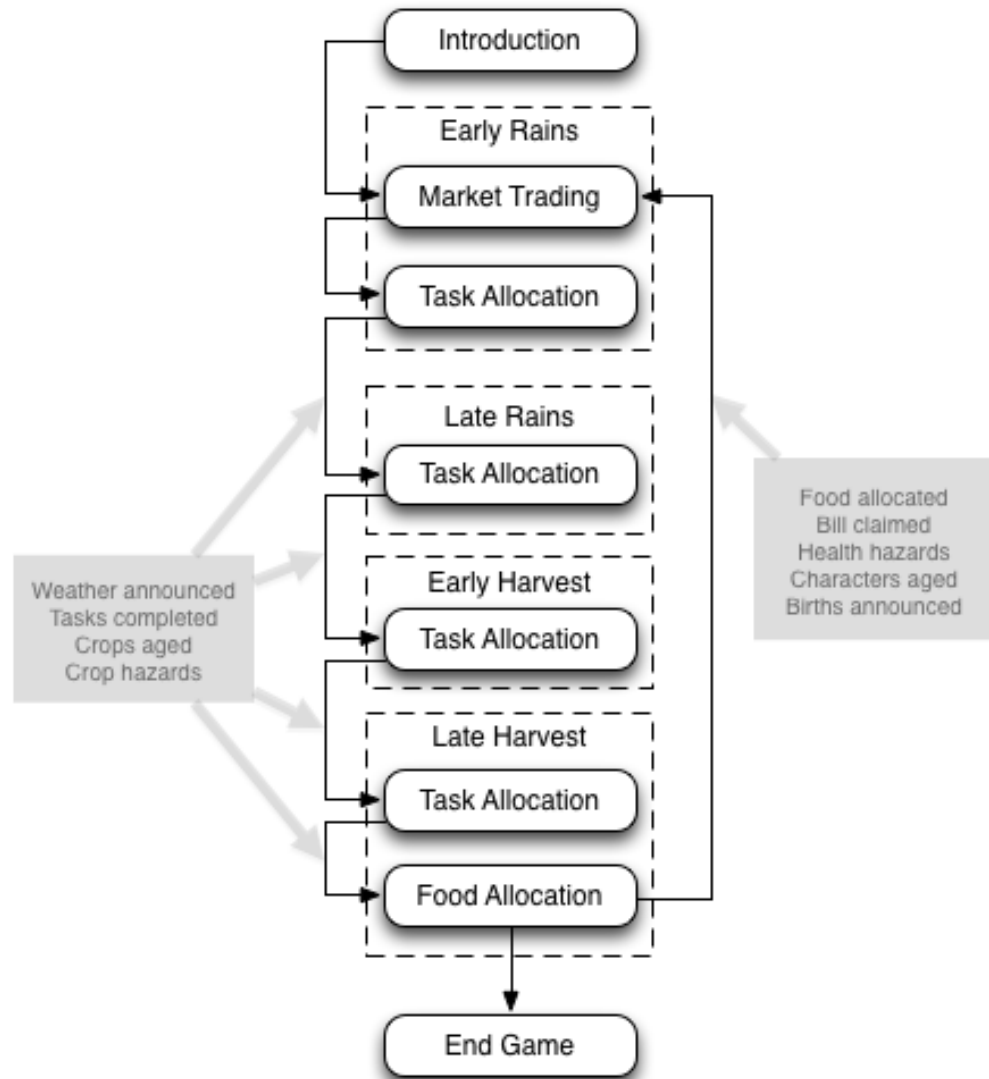
A requirement of the funding for this project is that the code produced must be open source if at all possible. Ideally the project should be able to be distributed for free. The game should not require an in-depth knowledge of networking, databases or computers to set up and run if at all possible.

The game may need to be updated in the future to represent different issues, or potentially different locations and/or crops. The code should be structured in such a way as to make this as straightforward as possible.

The game state should be maintained when the players log out of the system. This supports the requirement to make the game play time more flexible by allowing the players to leave the game for a period, knowing that when they return all will be as they left it. The table top games could not be left for fear of pieces being moved.

5.3 Design

The design of the system has three different aspects: the technical design chosen for the implementation, the procedural game play and the user interface design. These shall be

Figure 5.1: The *African Farmer Game*: game flow chart.

examined separately, referencing the way that the decisions made reflect the requirements outlined above.

5.3.1 Game Play

The game play and elements of the game had to simulate the annual growing cycle of the African farming year. Figure 5.1 shows an overview of the game processes. The game year was divided into four seasons, and each of these seasons associated with certain types of events. These seasons are further broken down into smaller stages, each giving the players a prompt as to what they are expected to be doing.

An initial stage is added at the start of the game, allowing players time to create users and join the game. Joining the game automatically assigns players to a player character.

This character is already situated in a household, with assets, non-playing characters (NPCs) and other players to get to know. The introductory stage also allows the users to start to become familiar with the interface.

Players are then moved into the start of the game year, called “Early Rains”. This season is split into two stages: market trading and task allocation. Market trading aims to encourage the players to consider their strategies for the upcoming year and buy the items needed for these strategies. The market remains open throughout the game so this is not their final opportunity, but it supports the pedagogical aim of the players considering the options they have available to them given their current situation. Task allocation then allows the players to begin implementing those strategies by allocating the tasks to different members of their household. Different tasks are available in the different seasons, and there are key household tasks that must be done every season. A list of the available tasks can be seen in Table 5.1.

When the tasks have been allocated the game manager moves the game on to the next season. This triggers the system to execute all of the tasks (allowing for failures due to insufficient stocks or overly busy family members). The weather that occurred during that season is then announced. This announcement happens after the allocation of tasks or the players would have too much information when they chose which crops to plant. Any crop hazards that occur are announced. Both crop hazards and poor weather reduce the health of any crops planted, and this reduces the yield from that crop. Information about what happened during the season is returned to the players.

The following two seasons (Late Rains and Early Harvest) consist solely of the Task Allocation stage. Players should weed any crops they have growing, and may choose to mitigate any crop pests they encounter with a generic pesticide. This will not reverse all of the damage done to the crops and may cost significant amounts. Crops must be harvested in the third season after planting (e.g. those planted in Early Rains must be harvested in Early Harvest) or they spoil in the field and the yield will be zero.

In the Late Harvest season, task allocation proceeds as normal. At the end of the task allocation stage the tasks are completed with any crops harvested, and the weather is announced. The game then proceeds to Food Allocation. This is where the families must decide what quality of diet they want feed each household member, and they must ensure that they have sufficient of each food item to meet their needs. This is extremely important, as family members may die from being underfed. The quality of the diet they are assigned also impacts their chances of getting ill – a good diet substantially reduces

Season	Available tasks
Early Rains	Sow Crop Babysit Farm for another family Go to school Housework
Late Rains	Sow Crop Babysit Farm for another family Go to school Housework Weed crop Apply fertiliser Apply pesticide Apply herbicide
Early Harvest	Harvest Crop Babysit Farm for another family Go to school Housework Weed crop Apply fertiliser Apply pesticide Apply herbicide
Late Harvest	Harvest Crop Babysit Farm for another family Go to school Housework

Table 5.1: The *African Farmer Game*: Tasks available by season.

the chances, whilst a poor diet may leave the individuals too weak to recover from an illness, and kill them. There are four diet levels possible in the game – A, B, C and X. A is the best diet, formed of good amounts and variety of food. A C-level diet will keep the individual alive, but really they are just subsisting and are more susceptible to illnesses. An X-level diet will not support the individual, who will die.

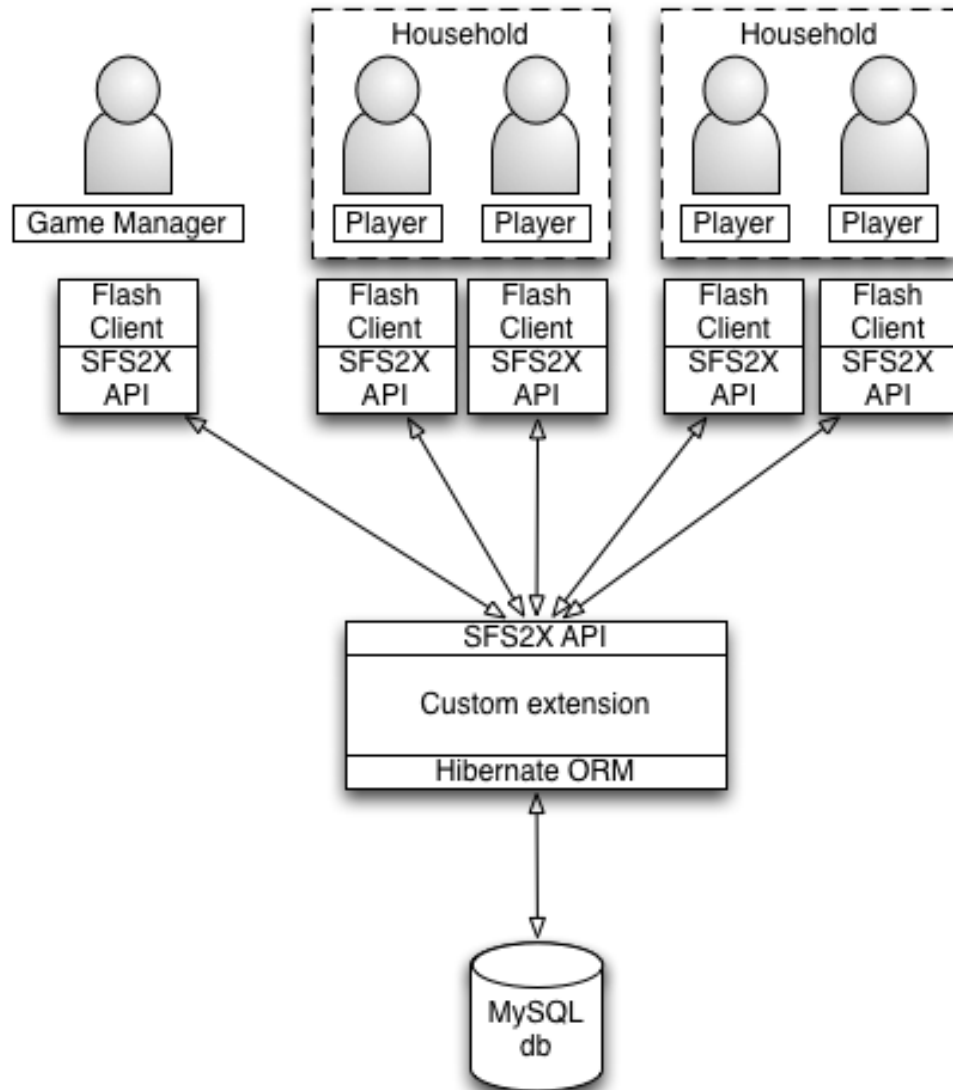
At the end of the food allocation stage the game manager moves the gameplay back to begin a new year. This is a key point in the game cycle. At this point the diets are applied and the food removed from the family’s allocation (the actual diets allocated are dependent on the amount of food that the family has available – just because an A-level diet has been assigned doesn’t automatically mean the individual gets that food if the family do not have it). The health hazards for each household member are then applied, and everyone is aged another year. This impacts the number and type of tasks that NPCs can perform and the amount of food they need as they grow from babies to children to adults. After this, births are calculated. Any adult female member has a chance of producing a baby, even if there are no adult males in the household². The annual accounts are done, and the outcomes of all of these events are communicated to the families. They then play another year.

This may continue for as long as the game manager deems fit. When the game manager wishes to end the game, they are then taken to the final “End game” section. This allows the game to feedback some measure of the families’ progress throughout the game, and provides the players some opportunity to talk over and reflect upon the results, the effectiveness of their plans and the things they would do differently if they played again.

5.3.2 Technical Implementation

Given the requirement for a multi-player game, a client-server architecture was required. The decision was made to write the client-side user interface using Adobe Flash, as this limits any potential problems with either operating system compatibility (a potential problem for applications) or browser compatibility (a problem for HTML5 applications). This does limit the availability of the game on iOS systems, but the game has initially been targeted at laptop or desktop users. The PureMVC framework was used to structure the ActionScript code, keeping the model, view and controller sections separate. This enabled an ongoing evolution of the visual components of the game without impacting the functionality. This structure was added to with a rudimentary state machine, with each

²This has caused some consternation amongst players, but we are reliably informed that this does happen and not just in Africa.

Figure 5.2: The *African Farmer Game*: system diagram.

screen of the user interface having its own class (view state), written to an interface. This allows additional screens to be created quickly with limited impact on previous screens.

The decision to write the client in Adobe Flash meant that the game server used also needed to function with Adobe Flash. It was decided to use gotoAndPlay()'s SmartFox-Server 2X server (SFS2X). This platform is provided with a Community Edition, which allows up to 100 concurrent users at a time. This should be sufficient for the kinds of numbers envisaged at the current time, and if at a later date this requirement is increased then a one-off purchase of the commercial license should be all that would be required to upgrade. This platform also makes setting up the server relatively simple, even for an inexperienced game manager. The platform supports the development of iOS apps, so it is possible that the game interface could (at a later date) be written to support these

devices.

Once the platform had been chosen the language for the heavy-lifting at the server-side was constrained by the APIs available for that platform. SFS2X allows for the production of custom “extensions” to be written in Java. The data for the game state is stored in a MySQL database, and this data is accessed from the Java Extension by using Hibernate as an Object/Relational Mapping (ORM) tool. Storing the data this way enables the players to log in or out without any loss of data. Where possible all calculations are performed by the back end code and the final data supplied for display in order to prevent potential code duplication and errors. However, in places where the response time required is too fast for a roundtrip to the server, the front end client does also do some small calculations. If there is a discrepancy between the two the backend code will take priority.

Separate version numbers have been maintained for the client, extension and database versions. As this code was developed between studies and is still under development, the versions of the *African Farmer Game* used will be provided with the details of the studies in Chapter 6, along with the version of SFS2X used.

Early in discussions it was found that there were a plethora of ideas for future development directions. Rather than continually expand the basic game, a decision was made to support the development of “expansion packs”. The idea is similar to that already seen in board games (e.g. the Settlers of Catan series of games), where there is a basic game and a series of variants and expansions which share a basic game mechanic but explore other milieus. Continuing with the Settlers of Catan as an example, the basic game is land based but they have the Seafarers expansion pack that includes the sea. This allows players to choose to expand the game as they grow familiar with the original rules, but leaves the basic game unchanged. For the *African Farmer Game* the basic game is already reasonably complex for new players. Expansion packs will allow for the growth of the game into new areas (e.g. climate change) without over-complicating the basic game and hopefully make the game more useful. To this end, the game play is primarily encapsulated in the Java extension on the server in a series of modular classes, which will allow future expansion packs to pull in some existing functionality whilst easily substituting other parts – for example, different seasons, or different tasks available within a season. The type of game is given an identifier, which is then placed into what SFS2X refers to as a “room variable”. This can be accessed by the front end client and used to switch to a different set of view states.

5.3.3 User Interface

The user interface was designed to support the main aspects of the game play. It was designed around five key “locations” for the players, each providing access to different sets of information³.

The user interface for the player and the game manager differ in a fundamental way: the game manager is supported by the system and where possible mistakes are caught by the system and prevented. The players, however, are given information about the things they are doing, but are allowed to make mistakes (e.g. forget how many tasks they have allocated to a person, or how much money they have left). The system is designed to be robust, but the humans using it are fallible. This relates to the pedagogical aims of increasing empathy with real-life farmers who do not have an in-built system preventing mistakes!

The two interfaces will be discussed separately below. However, the communication system is the same for all game participants, regardless of role.

In-Game Communication

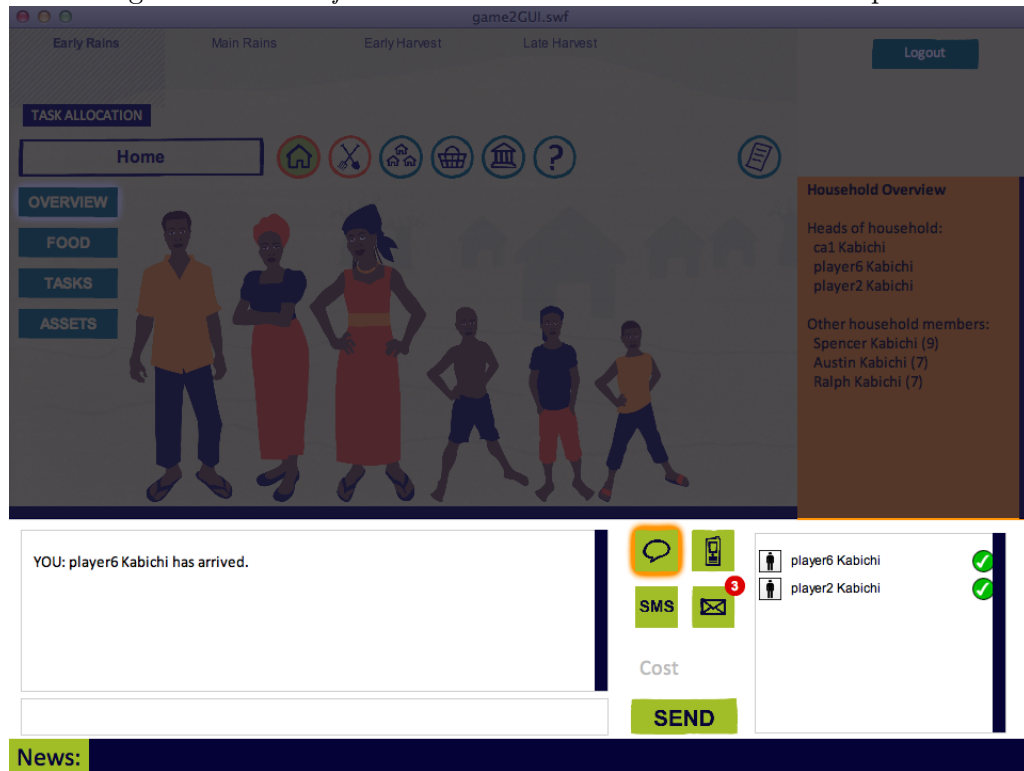
The key requirement for this game to be able to be played purely online led to the implementation of several different communication methods⁴. These were designed to mimic different forms of offline communication, again in keeping with an African farming community. The importance of the communication is such that it occupies the entire bottom of the screen.

The main communication panel is the same for all game participants including the game manager, and is shown in Figure 5.3. It mimics the format seen in other popular online text communication tools and games, with an input area at the bottom, a list of previous messages above, and a list of other players on the right. These tools are controlled by the four buttons in the middle of the panel.

SFS2X provides the capability to divide the game into online “rooms”, which enable the players to be arranged in different groups for interaction purposes. This has been utilised to try to make the communications more realistic. When the player has their communication set to talk, if they type into the input they send a message that everyone else in the same room can “hear” (i.e. it appears in their list of messages). Each family

³The locations and the information displayed were designed by the project team, but the creation of the visual assets was outsourced to Asilia (www.weareasilia.com/work/portfolio/african-farmer)

⁴All of the communication channels use text as voice over IP (VOIP) was considered too difficult for the timescales involved in producing the game.

Figure 5.3: The *African Farmer Game*: the communication panel.

has a separate home and farm room, with a shared village, market and bank room for the entire game. Players can see who is in the same room as them in the list on the right. The conversations are not saved for later review, in the same way as a verbal conversation leaves no record.

If players wish to speak to someone privately or in a different area they may click the phone icon. They then select a player from the list on the right, which now displays all of the villagers with details of their online status. If they select a player who is online, their phone will “ring” - the icon starts to flash for both players. A player may ignore the phone-call, or answer it and the two players can have a private conversation via the text chat. This data will not be saved for later review, again mimicking a phone conversation.

Players may also send SMS messages by selecting the SMS icon. They then see a full list of all players with information on whether they are currently online or not. They select from this list, type the message and hit send. They can also read their own stored SMS messages. These are private, and not shared by the rest of the family. SMS messages are widely used in Africa.

The final icon is a message area, which is used for messages from the system to the player. The players get end of stage reports, which are all stored in this way for them to look back at during future seasons.

There is also a news ticker across the bottom of the screen. The ticker can be set by the game manager, and is useful for supplying information to all players. This is a temporary news feed, and if a player is not online during the message period they will not be provided with the information later. This is somewhat similar to a radio news flash, or in the board game this is akin to the game manager shouting information to the room.

5.3.4 Player’s User Interface

The player’s user interface provides five locations in total: home, farm, village, market and bank. The functionality accessible from each is listed in Table 5.2. As alluded to in the Communication section, some of these locations are more private than others; each family has a separate home and farm views, which are only available to members of the household. The village, market and bank views are shared by all of the players, and provide areas for the different families to interact. Whilst the market and the bank are public areas, the information shown to the players remains specific to their household – just as when a person goes to a bank in real life.

Location	Available Actions	Accessibility
Home	View family Access task list Access diet allocations View family assets	Family members
Farm	View field and crop detail Access task list	Family members
Village	View information on other families Give family assets to other families	All players
Market	Buy goods Sell goods View family assets	All players
Bank	View bills	All players

Table 5.2: The *African Farmer Game*: Player locations and actions available.

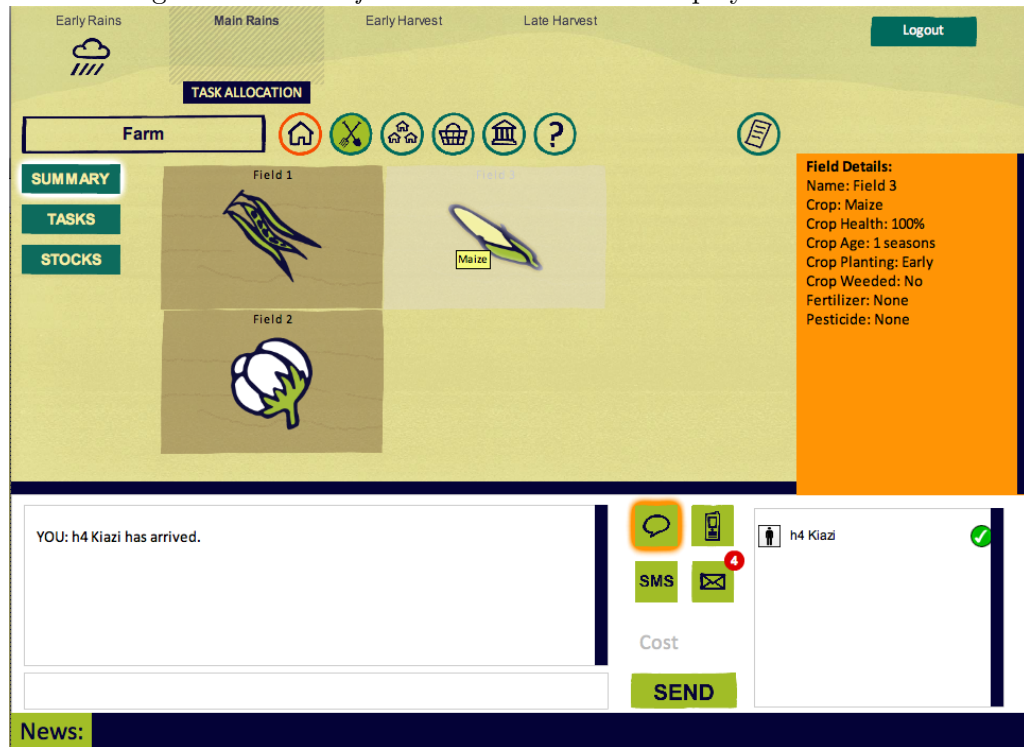
When a player accesses the functionality in a particular view (e.g. someone in the home view accesses the “Food” screen – see Figure 5.4 for details), they remain in the same game room and can continue to chat to other people in the home area. However, when they navigate between locations they change game rooms and can interact with

Figure 5.4: The *African Farmer Game*: home screen for a player.

different people. Their departure and arrival will be noted in the chat area for the players in the relevant areas, so if someone leaves the home area and heads to market the others in their home will be told of their departure, and the players already in the market will be informed that they have arrived.

Home

The home screen for the players is shown in 5.4 and provides an overview of the family, including all of the non-playing characters (NPCs). This overview includes the ages of the NPCs, their health and their current diet level. The home screen also provides access to screens to set up the diet allocations for the following year and the task allocation screen. These two screens are extremely important at different stages in the game year. The task structure is the main way for players to respond to the challenges in the environment. By allocating different tasks to the family members they can choose what crops to plant, whether to respond to crop pest attacks, and make sure they harvest their grown crops. The tasks that are available change depending on the season, but the players are allowed to make mistakes – e.g. try to plant crops that they do not have the seeds for, or over-allocate tasks to a particular player. This is deliberately designed to mimic real life (we all forget things or get things wrong occasionally) and to help to meet the pedagogical aims

Figure 5.5: The *African Farmer Game*: the player's farm view

of the game by making the players really concentrate on the decisions they are making.

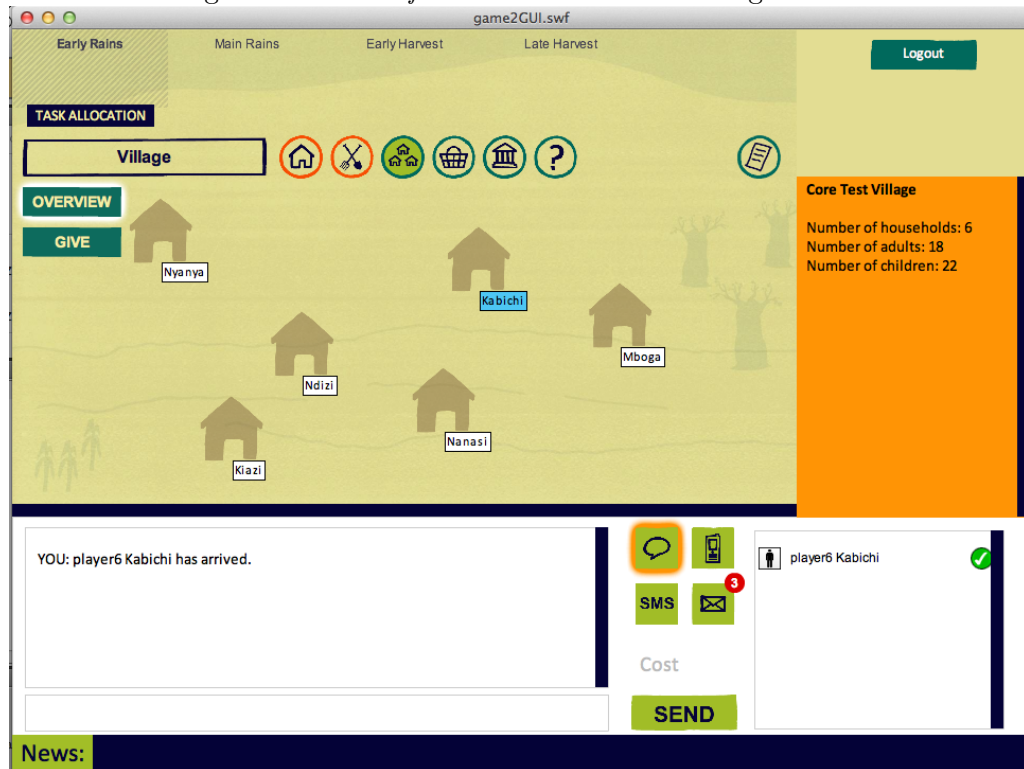
Farm

The farm screen for the players shows a representation of the fields owned by the family. As crops grow they are represented by an icon on the field (shown in Figure 5.5), and other icons for fertiliser, crop pests and so on are added as appropriate. The detail of the crop and the health of the crop can be accessed by clicking on the field. In Figure 5.5 the player has clicked on Field 3 and the details are shown in the orange panel on the right hand side of the screen.

Village

The village screen – shown in Figure 5.6 – is designed as an overview of all of the families in the village. By clicking on each house the players can gain basic information about the other families, such as the number of adults and children in the house, the names of the other households if they wish to contact them, or the number of fields they have. This is information that people would generally know about their neighbours in a village.

This screen also allows access to the “Give” functionality. This provides a way for the players to give different assets (including money) to other families. Rather than implement a rigid trade system where both sides of the trade are defined and collected immediately

Figure 5.6: The *African Farmer Game*: village screen.

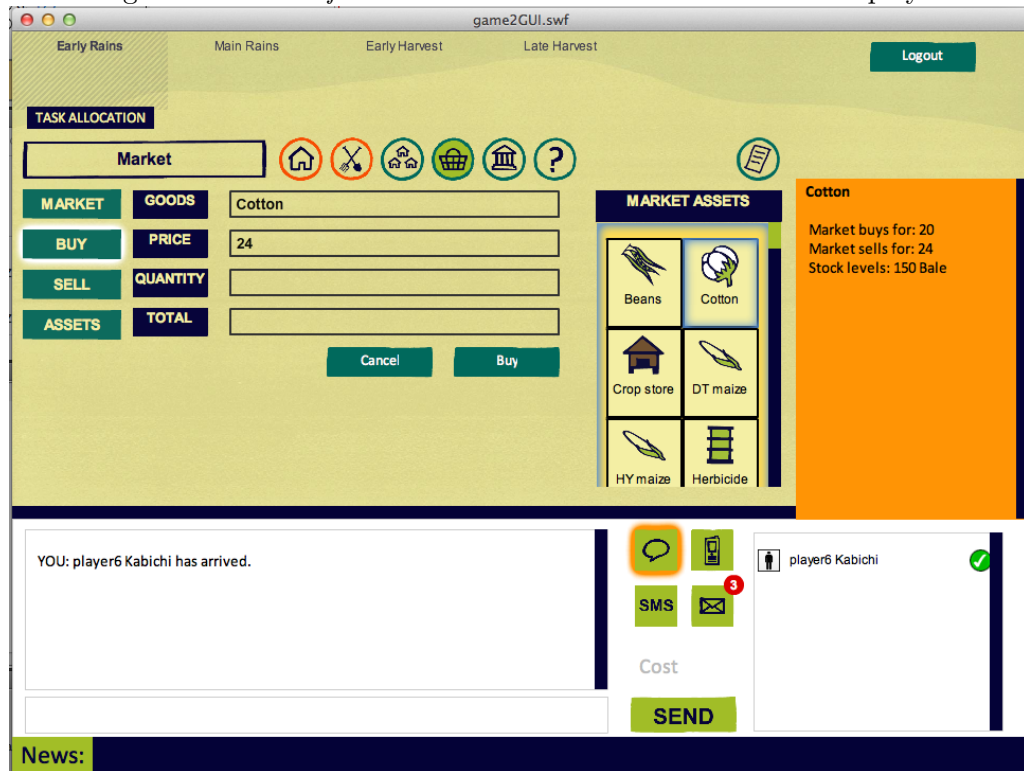
by the system, this allows the players to set up much more complex exchanges. They can be altruistic and give a family something as a gift, or offer them some seed in return for an amount of the crop at the end of the year, or even negotiate loans for varying rates of interest. When they do this they are having to trust that the other family will be able and willing to give them what they ask for in return. This again supports some realistic inter-team dynamics.

Market

The market is a key screen (shown in Figure 5.7), allowing the players to buy seed and other necessities and sell their produce. The market buys produce at a lower price than it sells for, which means that players need to think carefully about their purchases. There is no restriction on which family member can buy, and once the money is gone they cannot purchase any more goods.

Bank

The bank screen is the location for all things financial. For the players, the main purpose is the paying of bills. They can be hit by different types of bills at various points, from fines for forgetting to complete the household chores, to hospital bills for family members.

Figure 5.7: The *African Farmer Game*: market screen for a player.

There are also funeral costs for the dead, should the worst happen.

5.3.5 Game Manager's User Interface

The game manager's user interface is based around the same set of locations as the player. However, the information displayed for the game manager is different to that shown to the player in each location (see Table 5.3). The game manager has access to all of the different game locations, but the presence of the manager is not broadcast to the players. This change came from play-testing, when we found that the presence of the game manager disrupted the play and left them unable to monitor the play as they wished.

Home

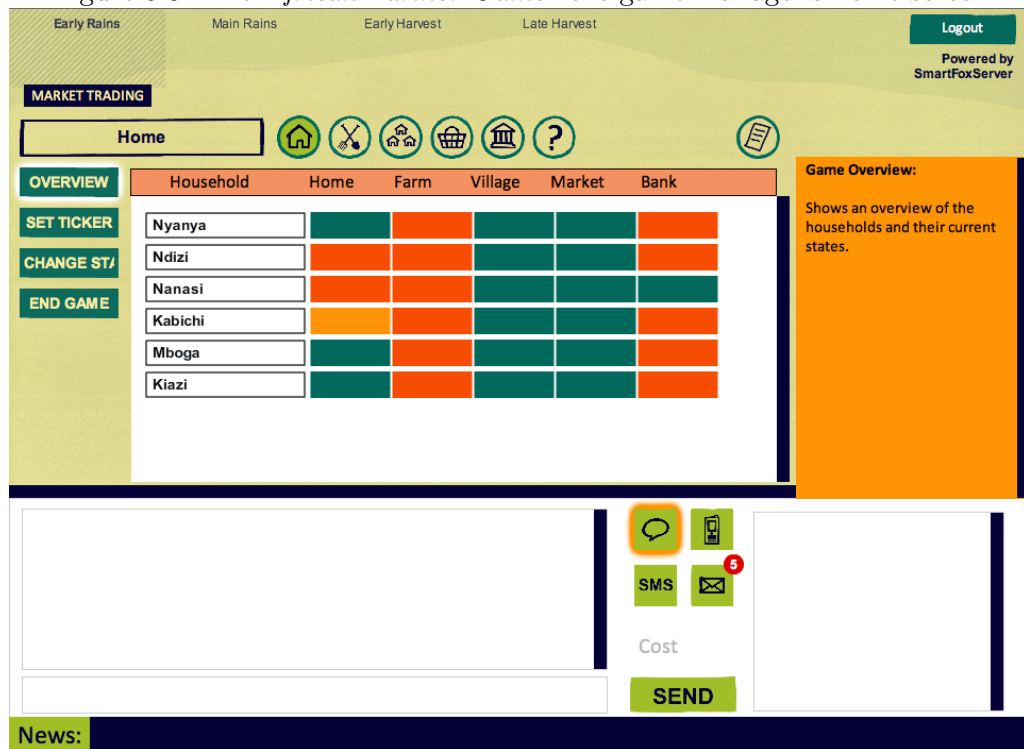
The game manager requires a different set of information to that shown to the players. The home screen for the game manager is therefore used differently, displaying a basic set of indicators for every family in the game (shown in Figure 5.8). This provides a simple visual check, highlighting the families that might be starting to struggle and allowing the game manager to investigate further.

This area also provides access to the functions that allow the game manager to move the game through the stages and finally end the game. By allowing the game manager to

Location	Available Actions	Accessibility
Home	View family traffic lights Send system-wide ticker messages See overview of stage progress Move to the next game stage End the game	Game manager only
Farm	Not currently used	Game manager only
Village	View information on other families Give assets to families Resurrect dead family members Access player views of family and farms	All players
Market	Change the price and availability of goods	All players
Bank	Assess players' wealth View players' bills	All players

Table 5.3: The *African Farmer Game*: game manager locations and actions available.

Figure 5.8: The *African Farmer Game*: the game manager's home screen.



choose the timings of these we hoped to increase the flexibility of the game, potentially allowing a game to be played in small sessions every week rather than in a single day (although that is also supported). The “Change Stage” screen provides the game manager with the name of both the current and the next stage, including the season. The “End Game” option is separate from changing the stage, as this is a final act which cannot be undone.

During task allocation and food allocation stages the game manager has an additional submenu item to allow them to judge the progress of the players through the tasks for that stage. The information provided is very simple, but is enough to suggest which families may be struggling and allow the game manager to check on them more closely.

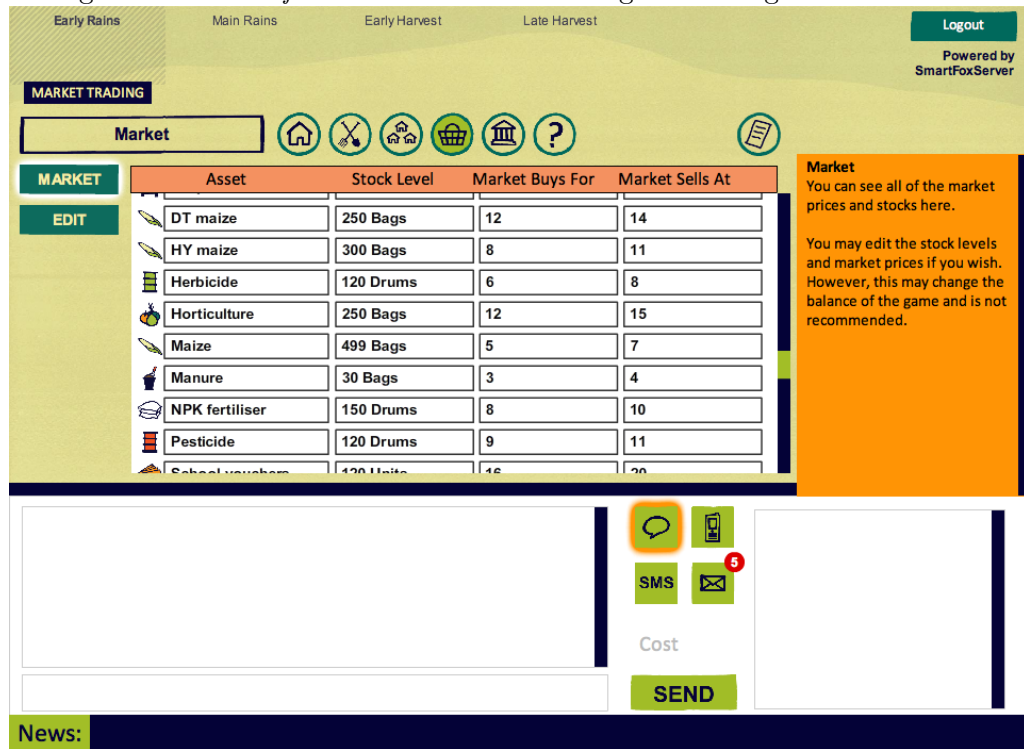
Farm

Currently the farm view for the game manager is not used. However, it would be possible to implement an overview of the village fields here at a later date.

Village

The game manager sees the same screen as the players do (see Figure 5.6), and may also give items to families using the same mechanism as implemented for the players. This allows the game manager to help families that are really struggling, and it is possible to disguise this as a chance event by sending a message at the same time (for example, as a relative who went to work in the city sends money back home, or corrupt politicians attempting to buy votes). The game manager has infinite stocks, whereas families can only give the assets they have.

In addition to accessing the “Give” functionality from this screen (which is identical to the player screen described in Section 5.3.4) the game manager can also access functionality that allows them to “Resurrect” players. Ideally this should only be used as a last resort, and the manager should preempt the need for this ahead of time. However, if the worst comes to the worst, this allows a game manager to bring a family back into the game by regenerating their players. This functionality does not extend to NPCs at the current time. The resurrection screen tries to simplify the process by only listing households that have players who need resurrecting, and then once a household has been selected only listing the player characters from that household who are in need of resurrection. When a player is resurrected their funeral costs are automatically marked as paid, their diet is reset to C-level, and a default food allocation is added for that player to each of the

Figure 5.9: The *African Farmer Game*: the game manager's market view.

household's saved food allocations.

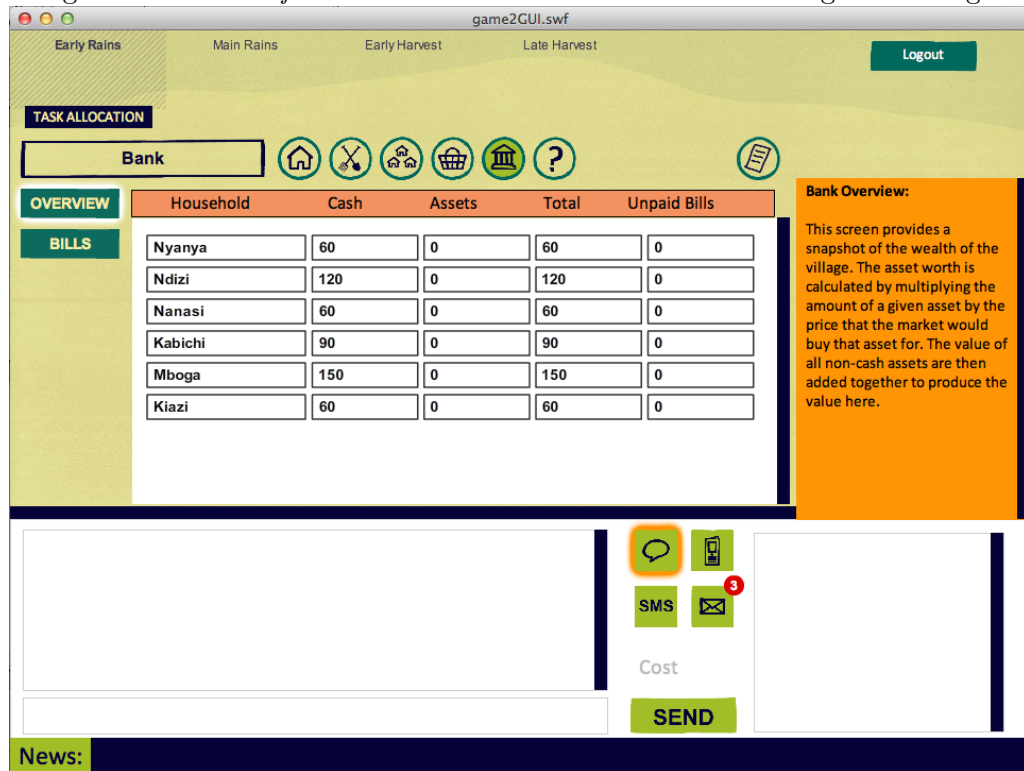
The other functionality available to the game manager from this screen is to access the home and farm screens for the various households. They do this by clicking on the doorways to the hut icon. They can then check the tasks that the family have entered, or the food they have allocated, and decide whether to intervene and make suggestions, or perhaps even move the season before they are 100% ready if they decide that the family have achieved enough to survive. However, the game manager cannot enter tasks or assign diets on behalf of the players.

Market

The game manager's market screen allows the game manager to manipulate the prices and stock levels of the various products. It is not recommended, but enables them to simulate different events (e.g. a global surplus of cotton which leads to reduced prices, or a government subsidy on fertiliser). User testing has indicated that there is not normally a need for this additional complexity during the first few annual cycles.

Bank

The game manager sees a full list of all of the households in the game with a view of their current cash and non-cash assets (see Figure 5.10). The value of the non-cash assets is

Figure 5.10: The *African Farmer Game*: bank screen for the game manager.

calculated at the price that the market would buy the assets for, rather than the price the players paid for them. The additional detail of the number of unpaid bills gives the game manager some warning of problems for a family. More detail can be seen in the “Bills” screen.

5.4 Game Reaction

One measure of the success of the game project is the extent to which the final game met the requirements discussed at the start of this chapter. This section will consider the reactions of the players to the game with these requirements in mind.

5.4.1 Usability

Although no formal study of the usability of the game was conducted, the players were asked for feedback at the end of every game. It was pleasing that the interface itself very rarely came up in these discussions. In fact, the interface was, to a great degree, a transparent part of the game – the discussions of the players during play revolved very much around the decisions they had to make rather than how to perform the actions required.

However, there were two areas that did present the players with some difficulties. One

was a bug in the drop-down lists used in the task allocation page. Just occasionally for some users, the drop-down lists would become unresponsive. Although this appeared in every game session we ran, it only appeared for some users, it did not appear every time for those users, and we were unable to recreate it in the development environment to debug it. The work around was for the user to log out, refresh the browser page and log back in, so it was not a show-stopper, but for some players this was very irritating.

The other, more critical area was the food allocation screens. A combination of the system allowing users to over-allocate food and the food not being taken out of the stores until the end of the stage seemed to confuse people. Sadly, this confusion resulted in a number of players killing their family members accidentally. The diets section of the food allocation screen was not used at all, and added to the confusion early in the game. This entire area should be redesigned to improve the clarity of the outcomes for the family.

5.4.2 Pedagogical Requirements

The clearest indication of whether the game had met its pedagogical requirements was to be found in the end of game discussion. The game was designed to stress the difficulty and uncertainty of the decisions that the farmers faced, and not to highlight specific farming techniques or crop choices. It was noticeable in all of the games that have been run by the project team (including those not included in the studies presented within this thesis) that all of the topics that the project sponsor wanted to be touched upon were. Frequently these topics were brought up by the players themselves, rather than the discussion mediator. Certainly in the project sponsor's eyes, this was one of the key achievements of the game.

One of the biggest questions that the players discussed at the end of the game revolved around schooling. The participants all had a high level of education, and many instinctively paid for school vouchers in the first year of a game. However, within the village setting and the timescales that the game tends to run for, there is no obvious, realistic short term reward, and by the second year most had abandoned the effort. Education takes a long time to pay off, and most obvious rewards were beyond the scope of this game. Players were very keen to help to find a way to make it a viable option within the game. One possible solution for the future would be to implement a "town" area, and allow the amount of education to affect the quality of the job that the family member could get. Of course, that removes labour from the village. Having no reward for sending a child to school was actually an interesting point for the participants to consider, as it led them to really question their instinctive push to educate their family members.

5.4.3 Technical Requirements

The client-server technology that we used within the game proved itself to be extremely robust on older computers. All of the games sessions and testing used an elderly PC as the server. The PC had been upgraded to a Windows 7 operating system, but had been deemed too old to be worth continuing to maintain and had been retired. This PC coped with the demands of the game with up to 20 connections at a time. SFS2X's use of a browser-based interface for the management function meant that the system requirements were low. In terms of the client PCs, we encouraged participants to bring their own computers where they could. All successfully connected to the game, although some seemed more prone to the problems with the drop-down lists mentioned above. For those who did not supply their own computers and for our own testing, we used a set of laptops purchased approximately six years previously. These laptops were still running the Windows XP operating system. These laptops ran the client software with no problems.

The ability to log out and log back in again was used frequently by those players hit by the problems with the drop-down list selector. When initially advised to do so, most players were concerned that they would lose all of their work so far. However, none did so. The constant feedback to the server allows immediate updates to other players, and also allows the game state to be maintained after the players have logged out.

The ability to add further game scenarios was tested by the addition of a second game variant. Writing a second variant lead to some further revision of the game structure to make it more flexible for future additions. However, overall the basic architecture responded well to this challenge.

In response to the requirement for the code to be open source, all of the code can be found in a public repository on the github platform, at <https://github.com/africanFarmerGame/afri-farmer-multiplay>. A compiled version of the code, along with instructions for installing and playing the game, can be found at <http://www.africanfarmergame.org/>.

5.5 Chapter Summary

This chapter has provided a detailed description of the *African Farmer Game*, from requirements to implementation.

The following chapter describes the second version of the game, and analyses the changes between versions and how it was expected that these changes would affect the reported team cohesion of the players of the two games. The results of the studies using

these two games are presented, and are discussed in relation to the research questions outlined in Chapter [1](#).

Chapter 6

Online Games

6.1 Introduction

This chapter describes two studies performed in 2013 with two versions of an online game partially designed for this purpose. The basic version of *The African Farmer Game* is described in more detail in Chapter 5. In this chapter the changes made to create the second version of the game will be described with reference to the ways that these changes mimic the differences seen in the two board games described in Chapter 4. The procedure followed for each game is outlined, including details of the participants. The results of the team cohesion and team member satisfaction measured in these studies will be discussed.

6.2 Games

In these studies two versions of *The African Farmer Game* were used. The underlying game is the same in both studies. Where the two versions differ is in the implementation of the rules around the timing of the team formation, the permeability of the teams, and whether the game feedback is presented to the entire team or split between the individuals.

6.2.1 Version 1 – Vanilla

Version 1 was as described in chapter 5. The rules regarding the game goals and teams in this vanilla version were designed to be as similar as possible to the rules for *The Green Revolution Game* (as described in Section 4.2). That is, the teams are formed as the player joins a game, without showing the player the asset and family size distribution of the teams. The players are not given any opportunity to change teams as the game progresses. The players are provided some basic feedback on both their financial states

and the dietary standard of their families on an on-going basis, but no comparison to other households is provided and all players see the same information throughout. This information is kept generic to allow the teams to use it in judging progress towards their goals, but does not prescribe an over-arching game goal on the play. The groups may decide that they wish to ignore the health of their family and concentrate on maximising wealth, or may choose to make the diets of their family as good as possible before thinking about wealth, or many other goals (i.e. secure the health of the village, corner the market in cotton... etc).

All members of a given household share a family name, used to identify them throughout the game.

For clarity, this version shall be referred to as *Vanilla AFG*.

6.2.2 Version 2 – Expansion

The second version was written as an “expansion pack”. All of the rules of the game were kept the same, other than those that pertain to the game goals and the teams. In this game when players initially join they are allocated to a player character. Male player characters do not start out with a household, but have a field allocation and some cash assets. Female player characters have a hearth and family and cash assets, but no field allocations. During the introduction stage of the game the players must form teams, by way of an extra section of interface in the village screen, shown in Figure 6.1

The homeless males appear on the right of the screen. Household details can be accessed by clicking on the household icons, and includes the in-game name of the player they may need to contact. Details of the males can be accessed by clicking on their icons. The players may choose to chat and negotiate a little, or could just make blind proposals. Any player may make a proposal, but the other party must accept before it becomes binding. Once the proposal has been accepted the cash assets and the fields become the property of the household as before – keeping separate purses is apparently common but was deemed too complicated for this game.

The proposals mechanism remains available throughout the course of the game, providing a mechanism by which the players could change teams if they wish.

As per *Vanilla AFG*, feedback on the assets that the family own and the quality of their diets is provided annually. However, in this game the information is split between the family members: female characters receive the information about the diets and the male characters receive the financial feedback. This is designed to highlight the differences

Figure 6.1: Expanded African Farmer Game: The village view shows any men who have not yet joined a family.



between individuals within the team, as opposed to the *Vanilla AFG* which highlights the team progress.

In an additional attempt to emphasise the individuality of the players, those assigned to male roles are assigned unique family names which never match those of the households. The female roles are already attached to a household and have responsibility for a number of non-playing characters (NPCs). Their family names are therefore also used to indicate the household, and are shared by all of the NPCs in the household. For example, Beatrice Karoti is assigned a family of three children. These three will all share the Karoti family name, and the household will show as the Karoti household in the user interface. The distinction between family names is maintained even after the male characters join a household (e.g., Wycliffe Stroberi could join the household of Beatrice Karoti, but neither changes their family name as a result), which highlights the difference between the players and their separate areas of responsibility within the team.

This game shall be referred to as the *Expansion AFG*.

6.2.3 Analysis

The differences between the vanilla and expansion versions are summarised in Table 6.1. These differences mimic the differences found in the two face-to-face games: the social

Vanilla AFG	Expansion AFG
Teams form randomly	Teams form with knowledge of assets
Teams are fixed	Teams may change
Teams share a family name	Individuals have unique family names
All team members receive the same feedback	Individuals receive different feedback

Table 6.1: Differences between Vanilla AFG and Expansion AFG

model of the *Vanilla AFG* is similar to the rules of the *Green Revolution Game*, whilst the *Expansion AFG* resembles *Africulture*.

A full analysis of the differences in these social models in relation to Social Identity Theory was performed in Section 4.2.3. The analysis is similar in this section. To recap, the lack of permeable boundaries in *Vanilla AFG* should lead to higher levels of team cohesion in this game (Ellemers, 1993). Sharing a family name and providing identical feedback to all family members should help to foreground the team identity for the players in *Vanilla AFG*, whereas the individual identity is expected to be more salient in the *Expansion AFG*; again, this should increase the team cohesion in the *Vanilla AFG* compared to that in the *Expansion AFG* (Reicher et al., 1995). In the *Expansion AFG*, team formation occurs at a point when players have greater knowledge of their teammates' potential assets within the game, which may help to lift the cohesion of the lower performing teams in the *Expansion AFG* (Ellemers et al., 1999), but this is not expected to be sufficient to counter the other factors.

In short, it is hypothesised that the players of the *Vanilla AFG* will display a greater team cohesion than those playing the *Expansion AFG*.

6.3 Method

6.3.1 Participants

The *Vanilla AFG* was offered as an extra-curricular event as part of the 2013 STEPS Centre Summer School on Pathways to Sustainability. This international summer school was held at the Institute of Development Studies for two weeks in May and was aimed at doctoral and post-doctoral researchers (or those with equivalent experience). Fifteen participants (six female, nine male) signed up to play on the middle Sunday of the fortnight. The participants were aged between 26 and 41, with a mean age of 30.9¹. The *Expansion*

¹Two players declined to provide their ages. This range and mean is calculated for the remaining 13.

Program	Vanilla AFG	Expansion AFG
African Farmer GUI	FE1.13.0	FE(a)3.0.11
African Farmer Backend	BE1.16.0	BE(a)2.0.24
African Farmer Database	DB1.5.0	DB(a)3.0.2

Table 6.2: Version numbers of the three components of *The African Farmer Game* as used in each study.

AFG was offered as a one-off special event to students and staff at the Institute for Development Studies. Twelve players played (six male, six female), aged between 23 and 65. The mean age was 33.3²

6.3.2 Apparatus

The development of the game continued after these studies were concluded, and later versions of the game have greater functionality available to the players. The versions used in these studies were therefore noted and can be seen in Table 6.2. The differences between the two versions mostly centre on the game manager user interface³, with bug fixes rather than functionality changes for the players themselves (other than those changes described in Section 6.2 above).

6.3.3 Procedure

The room was set out in a similar way for each of the online game sessions. A number of tables were set out at random, each of which had three chairs and a power cable for participants to plug in computers as required. Players were advised to bring a laptop when they signed up for the session. Some extra laptops were supplied to participants who could not bring their own so that no participants were required to share computer equipment. The game was run on a local server over a private wireless network. Participants logged on to this private network and were asked to navigate to a specified URL where they could access the correct game with the credentials supplied. Once players were logged on to the private network they could no longer access the internet via their computers (although there was no moratorium on using other devices to do so). Both games were played for a total of 3 hours (including lunch) and in both games three annual cycles were completed.

²One player did not provide their age, so this range and mean is calculated for 11 of the participants.

³The game manager user interface was actually non-existent for the *Vanilla AFG* session, other than a button for moving to the next season. Surveillance was achieved directly via the database tables. This was sub-optimal.

Method	Scope
Chat	Players in the same game room.
Mobile phone	Any online player in the same game.
Text messaging	Asynchronous delivery to any player in the same game.

Table 6.3: The communication methods available to players within the African Farmer Game

The participants were not informed how many annual cycles they would be completing in an attempt to prevent them from changing strategy in the final round, although they could potentially have guessed when the final annual cycle would be based on the time.

The game was introduced, and a game was set up with one player character per player. These were divided into households of two or three, plus a “banker” character for the game manager.

The game manager only moved to the next seasons once all participants agreed they were ready. The players could talk to each other directly or use the in-game written communication methods. The in-game methods are listed in Table 6.3⁴.

At the end of the game a mediated group discussion was held. Topics covered included the respective household sizes, the strategies they used, and why. Players then reflected on the extent to which these strategies worked within the game and how they might have been changed to be more successful. The final part of the discussion focused on the game itself and the improvements that could be made to it.

Vanilla AFG

The room was laid out with seven tables. As participants arrived they were encouraged to sit at any of the tables and to set up their laptops. The players’ teams were dictated by the tables they were sitting at; the game manager provided each player with the login details for a specific family member (although the families were randomly allocated to the tables). This is similar to the start of the *Green Revolution Game*. When the players logged in the they were first taken to the household view, where they could ‘meet’ their full family of NPCs and find out how many fields and other assets they had been allocated.

⁴The game is divided into a series of “rooms”, which group the players into locations. The chat functionality utilises this.

	Vanilla AFG	Expansion AFG
Median	59.00	60.00
Minimum	46.00	49.00
Maximum	70.00	69.00

Table 6.4: Team cohesion scores for the face-to-face games as a function of game played.

Expansion AFG

The room was laid out with nine tables. Once again, participants were encouraged to sit at any of the tables. This time the login details were distributed in such a way as to prevent players already sitting together from forming a team. The players then had to negotiate the family formation stage, and then physically relocate to sit as a family unit to play the rest of the game.

6.4 Results

6.4.1 Team Cohesion

Table 6.4 shows the median and range for the team cohesion measure in each game. The difference in team cohesion produced between the two games was non-significant using a one-tailed Mann-Whitney test ($U=70.5$, ns, $r=-0.18$). This test was one-tailed due to the hypothesis made in Section 6.2.3.

6.4.2 Team Member Satisfaction

As shown in table 6.5 there were no significant differences (using a two-tailed Mann-Whitney test) between the two games for the overall satisfaction measure ($U=87.00$, ns, $r=-.03$). Similarly, there were no significant differences in mixed-motive ($U=85.5$, ns, $r=-.04$), communication rating ($U=72.5$, ns, $r=-.16$) or the fairness rating ($U=73.5$, ns, $r=-.16$).

6.5 Discussion

The data presented in this chapter examined whether the team cohesion and team member satisfaction would vary between two versions of an online game which were designed to produce a difference in team cohesion.

RQ1: To what extent do the real-world findings from Social Identity Theory translate

	Vanilla AFG			Expansion AFG		
	Median	Min.	Max.	Median	Min.	Max.
Team member satisfaction	82.00	70.00	98.00	73.50	65.00	93.00
Mixed motive	35.00	21.00	49.00	36.00	22.00	44.00
Communication	30.00	20.00	34.00	30.50	26.00	35.00
Fairness	13.00	7.00	14.00	12.00	6.00	14.00

Table 6.5: Team member satisfaction factor scores as a function of game played

to game worlds? What effect does changing the game rules have on the team cohesion levels reported by the players?

It appeared possible to translate the group conditions into social conditions that should have mimicked situations examined in Social Identity Theory. However, we found that there were no significant differences in team cohesion or team member satisfaction. This was not the expected result, given the analysis of the differences in the games laid out in Section 6.2.3. In the reflective discussions at the end of the game, the players of *Expanded AFG* did seem very conscious of the different names of the members of the household, and made greater reference to their own reasoning for decisions rather than group ones – particularly around decisions made at the start of the game. This is anecdotal evidence however, which has not been supported by the statistical results. There are a number of reasons this may have been evident.

The first reason may have been a quirk of the team set-up in the *Vanilla AFG*: when the players of the *Vanilla AFG* formed into teams by choosing where to sit, unlike any of the other games, all of the groups formed along gender lines. This difference in group composition in this game may have had some effect on the average levels of cohesion reported by players of this game, potentially causing a smaller difference between the two game versions than may otherwise have been seen. We shall return to this in more detail in Chapter 8. The variation in team formation is a consequence of allowing the players to choose who they sat with when they arrived at the game, which was done deliberately as the timing of the group formation was one of the factors being explored. However, this could have been manipulated without much difficulty if the effect on the outcome had been predicted.

The other potential reason relates to the design of the online game, and leads on to another of the research questions.

RQ3: What is the effect on both team cohesion and team member satisfaction from

moving the game from a face-to-face to an online condition?

There is some question in the online game over which of the players' identities were made salient. In order to identify who was logged in and who performed various actions, the players were assigned an avatar amongst the family members. This differs from the setup with the *Green Revolution Game*, which does not assign any particular token to a player but shares a set of generic family tokens amongst the group. It may be that the act of assigning a unique token to the player increased the salience of the individual identity, even where in the *Vanilla AFG* there was a shared group identifier in terms of the family name. Making the players' individual identity more salient would have the effect of reducing team cohesion in what was intended to be a high team cohesion condition, reducing the difference between the two games and resulting in no significant differences between the two.

Anecdotally, this is supported by findings from the early trial of the questionnaire, using the cooperative *Lord of the Rings* board game designed by Reiner Knizia. This game assigned tokens to players within the group, each a unique hobbit with different abilities. This was supposed to strengthen the group, by introducing interdependence with the differing abilities (Knizia, 2004). However, the players instead displayed a tendency to protect "their" token, attempting to "hide" behind other players, or pushing another group member forward ahead of themselves, even though this made no difference to the outcome – the group can only win or lose together, the state of an individual is irrelevant within the game.

Returning to *Expanded AFG*, although the different types of data provided to the players at the end of an annual cycle was intended to emphasise the different goals for the two player roles, there was anecdotal evidence of the players working together to share the information provided. This may have had the unintentional consequence of producing greater interdependence and cohesion in this game, giving the players an opportunity to communicate and reinforcing the idea that individually they had very incomplete information. So rather than decreasing the salience of the team identity as designed, this may have actually increased it, further reducing the difference between the two games.

It is interesting to note that in their social identity model of deindividuation (SIDE) Reicher et al. (1995) found that in online conditions where players were unable to see or identify each other ("deindividuation" conditions), salience of group membership was increased even though the players were completely alone. They found that when deindividuated participants were addressed solely as group members, the salience of their group

membership was higher than that of a face-to-face group addressed the same way. They suggest that the visibility of the other players also increases visibility of the differences between the players in the group condition, whereas in an online situation the group membership may be used to compensate for a lack of social cues. In the case of all four games in our study the players could see one another. It would perhaps be interesting to contrast this with a game played in deindividuated settings in a further study.

These findings do suggest that “translating” game rules from an existing face-to-face game to an online version requires care. It appears that superficially insignificant decisions can have larger-than-expected consequences!

RQ2: How does the level of in-group identification reported relate to team member satisfaction?

The results for all of the team member satisfaction measures were non-significant. Again, this is similar to the findings for the team cohesion, but no conclusions can be drawn from the results of these studies.

6.6 Chapter Summary

This chapter presented the results for team cohesion and team member satisfaction from two similar online games. The translation of the game rules from the two face-to-face games described in Chapter 4 to the online games was described, and the differences were analysed with reference to Social Identity Theory. This analysis predicted that players of *Vanilla AFG* would report a higher level of team cohesion than those of *Expanded AFG*, but no significant differences were found. Possible reasons for this were discussed, and some of the differences between designing for the online and face-to-face domains were highlighted.

The next chapter will consider factors beyond the game rules which potentially affect the team cohesion and satisfaction, looking at results across all four games.

Chapter 7

Beyond The Game Rules

7.1 Introduction

This chapter moves beyond the effects of the game rules and returns to some of the other research questions posed at the start of the thesis. In answer to *RQ2: How does the level of in-group identification reported relate to team member satisfaction?*, the relationship between team cohesion and team member satisfaction is reviewed across all four games.

RQ3: What is the effect on both team cohesion and team member satisfaction of moving the game from a face-to-face to an online condition? is revisited, with the overall results from the two online games being compared to those from the two face-to-face games.

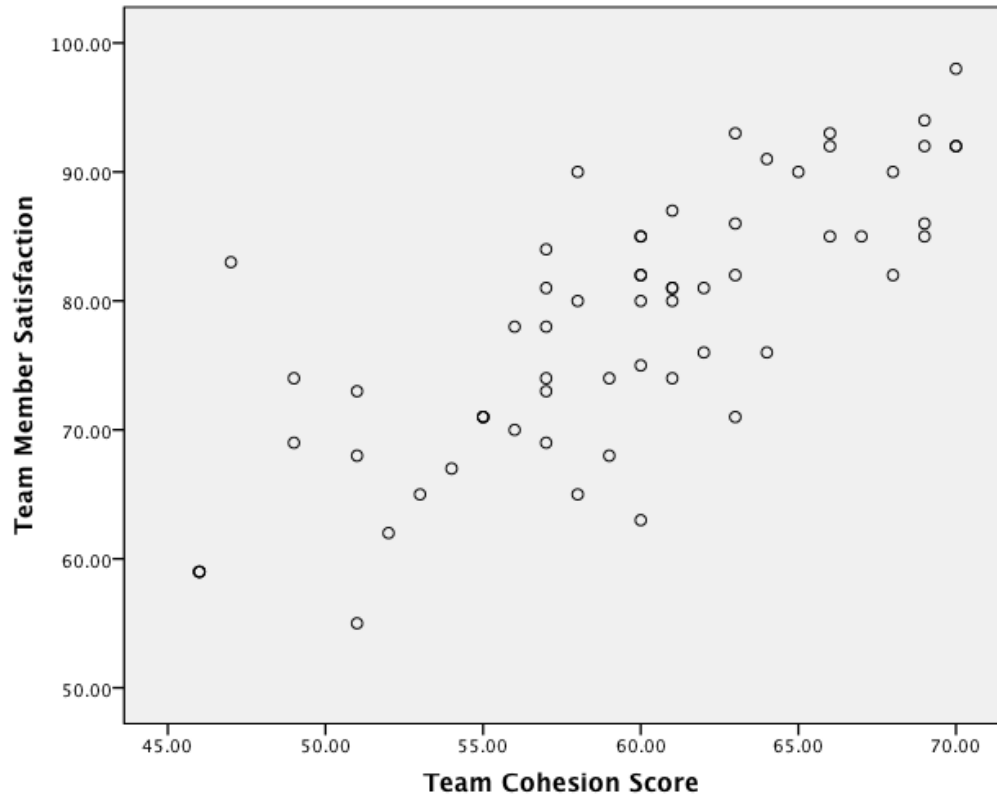
And finally, *RQ4: How do more individual factors such as the player's self-reported preference for group work or the number of people they know in their team affect the team cohesion and team member satisfaction as reported by the player?* is also examined. The players' reported preferences for group work and the number of their group known prior to playing the game is related to the reported team cohesion and overall team member satisfaction.

7.2 Results

7.2.1 Team Cohesion and Team Member Satisfaction

Figure 7.1 shows the scatter plot for Team Member Satisfaction vs Team Cohesion scores reported across all four studies. The Spearman's rho revealed a statistically significant strong correlation between the two ($r_{s[62]}=.62$, $p<0.001$).

Figure 7.1: Scatter plot of Team Member Satisfaction Scores vs Team Cohesion Score



7.2.2 Online Versus Tabletop

The reported ratings for team cohesion and overall team member satisfaction from the two online games were combined and compared to the combined results from the two face-to-face games. The bar chart presented in Figure 7.2 shows the range of values for the two game situations, the upper and lower quartiles and the median values, whilst Figure 7.3 shows the same values for the team member satisfaction. Neither the team cohesion ($U=435.5$, $r=-.07$, ns) nor the team member satisfaction ($U=435.5$, $r=-.07$, ns) show any significant differences between the two situations.

7.2.3 Group Work Preference

In response to the question on group versus individual working preference, most ($N=40$) said it depended on the work, but a number ($N=21$) said they always prefer working in groups. Only one player said they always prefer to work alone. Figure 7.4 shows that only one study featured more participants who preferred group work as a rule. Using a Kruskal-Wallis test the team cohesion rating was not found to be significantly affected by the player's reported liking for group work ($H(2)=2.554$, ns). However, the team member satisfaction was found to be significantly affected ($H(2)=9.759$, $p<0.01$). A Mann-Whitney

Figure 7.2: Team cohesion scores by game situation (online vs. tabletop)

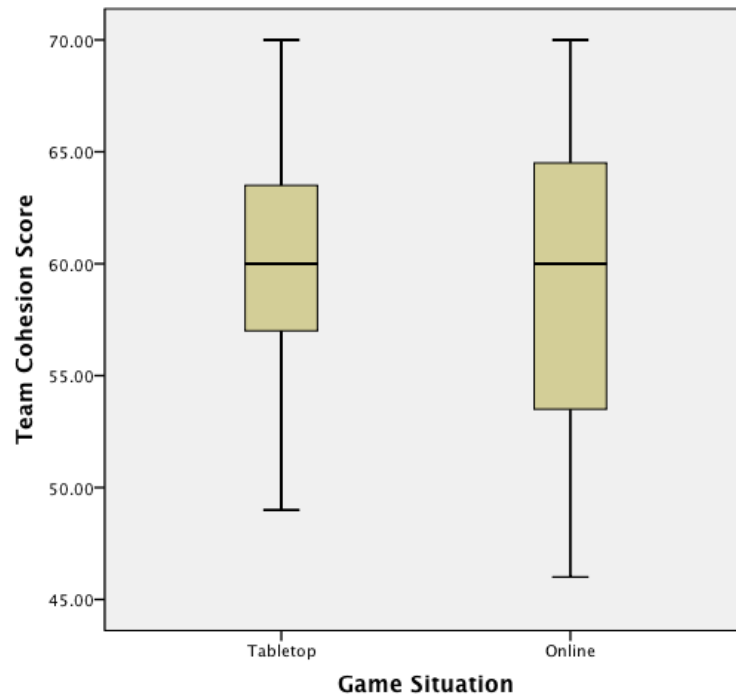


Figure 7.3: Team member satisfaction ratings by game situation (online vs. tabletop)

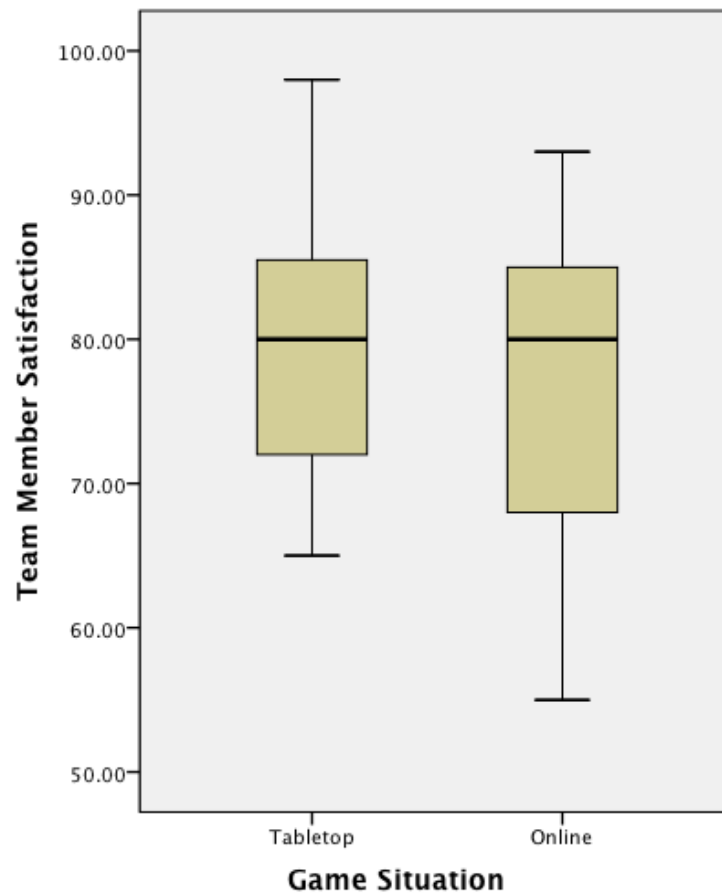
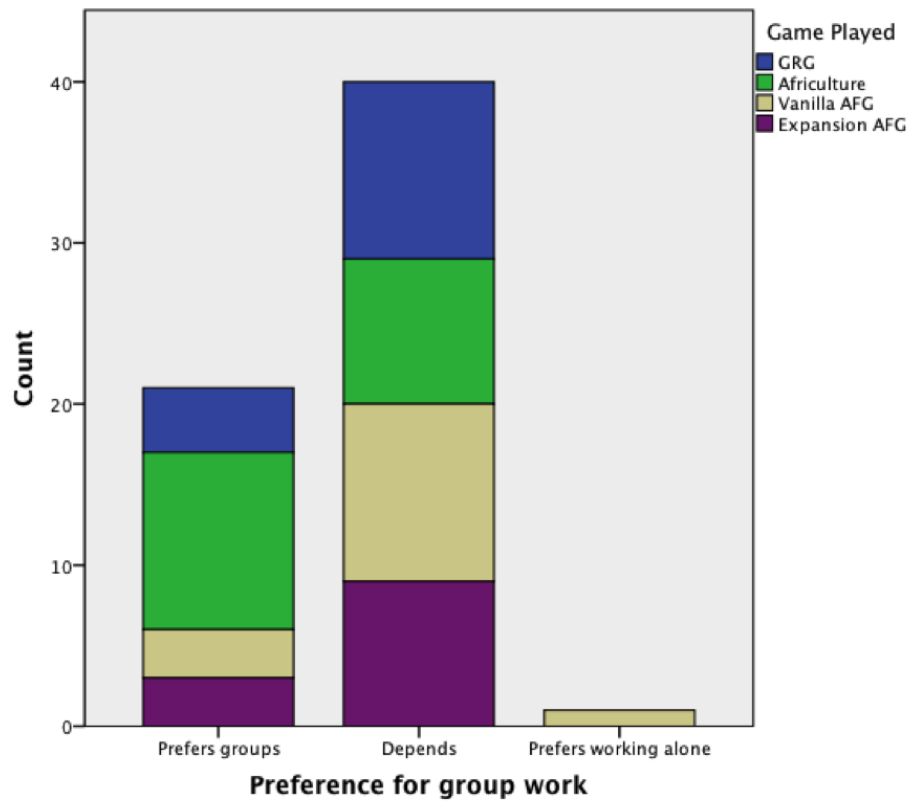


Figure 7.4: Frequency distribution of players' preference for group work.



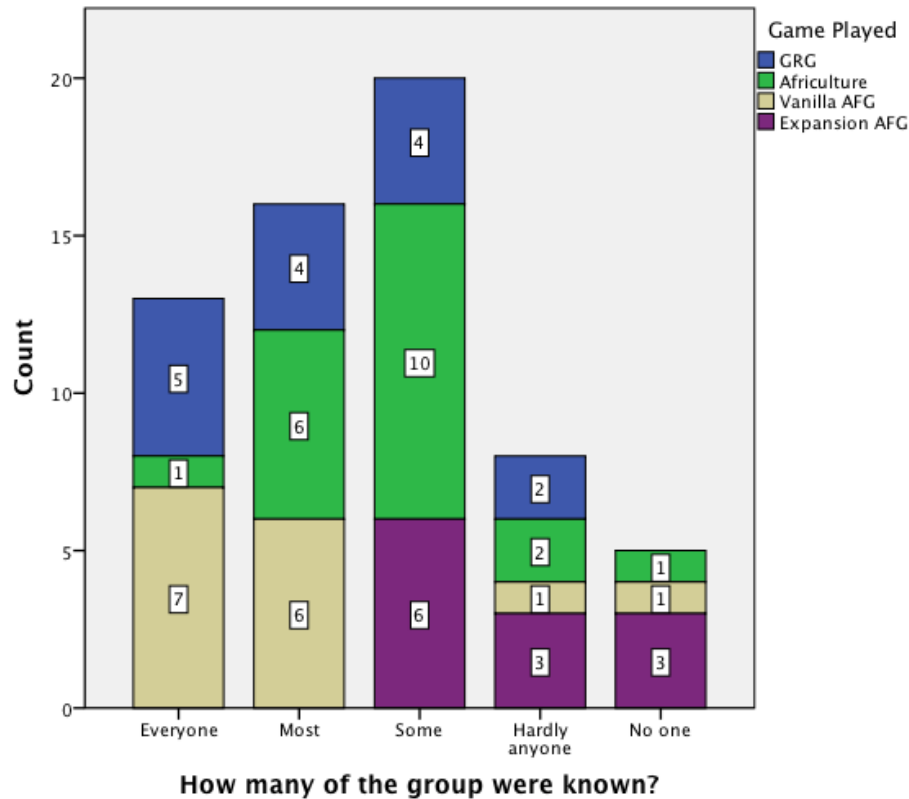
test was used to follow up, comparing those who predominantly preferred group work to those who stated that it depended on the situation. A significant difference was found ($U=245.00$, $r=-.34$, $p<0.1$), with those who stated that they prefer group work reporting lower team member satisfaction than those who said it depends on the work. With only a single player saying they prefer to work alone the sample size for this group is too small for reliable statistical analysis.

7.2.4 Number of Group Known

Figure 7.5 displays the results of how many people each player knew prior to the game session. A Kruskal-Wallis test showed that the number of players known did not significantly affect the team cohesion rating ($H(4)=1.965$, ns). The overall team member satisfaction score was also not significantly affected by the number of the group known ($H(4)=8.266$, ns).

To test the hypothesis that players who knew everyone in their group would report higher cohesion levels than those who did not, all of the players who said they knew less than everyone in their test were combined and the team cohesion ratings were compared with those of the players who claimed to know everyone. A Mann-Whitney test showed

Figure 7.5: Frequency distribution of the number of group members each player felt they knew before playing.



no significant differences between the two groups ($U=291.5$, ns, $r=-0.037$).

7.3 Discussion

The results presented in this chapter refer to a number of items unrelated to game design issues. A strong correlation was found between team cohesion and team member satisfaction. However, no relationship was found between the number of players known before the start of the game and either team cohesion or team member satisfaction. Team cohesion was not found to relate to the player's stated preference for group work, although a relationship between this and team member satisfaction was found.

RQ2: How does the level of in-group identification reported relate to team member satisfaction?

As stated above, a strong correlation was found between team cohesion and the overall measure of team member satisfaction. This correlation does support the idea that a player who is identifying strongly with their team will also feel satisfied with their group membership. The literature reviewed in Section 2.5 suggested that fairness had a link with team cohesion, but was less clear on links with communication or conflict between team

and individual goals and team cohesion levels.

RQ3: What is the effect on both team cohesion and team member satisfaction from moving the game from a face-to-face to an online condition?

No significant difference was found between the team cohesion reported in the face to face games compared to those in the online condition. This suggests that overall there was little difference in the two conditions. However, the results reported in Chapter 6 show no significant difference in team cohesion between the two games in the online condition, whereas the two face-to-face games did.

A number of ways that the salience of the individual identities of the players may have been increased in the *Vanilla AFG* were outlined in Chapter 6.

RQ4: How do more individual factors such as the player's self-reported preference for group work or the number of people they know in their team affect the team cohesion and team member satisfaction as reported by the player?

Two possible effects of a longer relationship (i.e. knowing each other prior to the game) between team members were identified in Chapter 2: the group would have formed a number of subgroups, possibly reducing the cohesion of the group overall ([Ashforth and Mael, 1989](#)), or the group would have been more cohesive due to the increased duration of the group ([King et al., 2009](#)). However, it appears from this data that there was no overall relationship between the number of players known before the play started and either the team cohesion or team member satisfaction.

The research presented in Section 2.4.2 suggested that players who reported knowing everyone in their team before the start of play would report a higher level of team cohesion at the end of play than those who did not. However, this was also not backed up by the results, which show no significant difference between these players and those who did not know their teams prior to starting the game.

It is interesting to note that there did not appear to be a consensus amongst team members on the number known within the team. There were cases where players within the same team reported knowing everyone, whilst their teammates reported a much lower level of familiarity. This means that it is not possible to investigate the effect of subgroups within a team on the cohesion levels. It is not clear why this may be, but it is possible that the wording of the question was not sufficiently precise. The trial game only featured a single team, so the wording was unambiguous. In a multi-team situation it was not clear whether the question was about the people within the team or everyone playing the game. It may also be that the five options provided were too many, and prone to

misinterpretation.

The preference for group work likewise was not found to have any correlation with the team cohesion. In this research the preference for group work was used as something of an indicator for the extroversion of the individual. The lack of research linking extroversion and team cohesion did not allow a hypothesis on any potential relationship between the two, and this result does not add to the existing research.

The measure of team member satisfaction does appear to be significantly affected by the preference for group work. The extremely small sample size for always preferring to work alone does cause some problems with this finding, although the difference between the remaining two categories is significant. It is not, however, in the direction that may have been expected: those who claim to prefer group work reported lower team member satisfaction than those who report being more ambivalent towards group work. It is not clear why this would be the case. This is also the only measure where the team member satisfaction shows a strong effect whilst the team cohesion does not: the game played had a significant effect on both team member satisfaction and cohesion in the face-to-face setting. Further research is needed to confirm this result. However, the low number in the sample that said they prefer to work alone does emphasise the relative homogeneity of the sample.

7.4 Chapter Summary

This chapter has presented the results across all four games, looking at factors beyond the design of the game rules. The relationship between the preference for group work and team cohesion was found to be non-significant, as was the relationship between the number of teammates known at the start of the game and both team cohesion and team member satisfaction. A possible relationship between team member satisfaction and preference for group work was noted. A strong correlation between team member satisfaction and team cohesion was discussed. The results from the online games were compared with those from the face-to-face games, and no significant differences found. Although this suggests that the two contexts are superficially similar, the results from previous chapters suggest that this is not true at a more granular level.

The following chapter continues to examine the team members and the make up of the teams. The gender of the individual players is related to team cohesion and team member satisfaction. The effect of team composition is also analysed.

Chapter 8

Gender Differences

8.1 Introduction

Although the studies reported in this thesis were not initially designed to look for gender differences in team cohesion, the study using the *Vanilla African Farmer Game* (as described in Chapter 6) revealed some interesting findings. Throughout all of the studies, the participants were asked to form into self-selecting teams (as would usually be the case in a game). On this particular occasion, the teams spontaneously formed along gender lines, with four teams of men and three teams of women. This was unusual and did not happen in the other three studies. The groupings in this study exposed differences in team cohesion and team satisfaction between genders in single-sex groups and suggested that player gender and group gender composition should be considered.

In this chapter we shall report the background research on gender in games in general, and in relation to team cohesion and team member satisfaction in particular. We shall also consider any likely differences in tactics between teams of different gender composition. The results across all four studies will be discussed, relating differences in reported team cohesion and team member satisfaction to both the gender of the participant and also the gender composition of the team (all-female, all-male and mixed).

8.2 Background

8.2.1 Gender Theories

Differentiation between sex and gender first seems to have been made by Ann Oakley, in her book ‘Sex, Gender and Society’ (Oakley, 1985). In this book she defines ‘sex’ as pertaining to the biological differences between male and female, whereas ‘gender’

is cultural, referring to the difference between masculine and feminine. [Butler \(1999\)](#) disagrees, arguing that if gender is a social construction then the biology or sex of the body affects the interpretation of the gender and cannot be separated. However, [Bradley \(2007\)](#) suggests that this complicates things unnecessarily, and risks conflating biology with identity in ways that are unhelpful. In this case the participants were asked simply whether they were male or female, which is perhaps an over-simplification but was a suitable level of detail for this thesis. Gender roles were not the initial focus of the research, and as such further clarification was not felt necessary.

The team situation explored in this study presents two different questions: is there any difference between the team cohesion and team member satisfaction reported by female players versus male, and what is the effect of the gender composition of the team on the reported team cohesion? The gender composition of the team relates more to the performative aspects of gender, with players potentially reacting to what they feel may be the expectations of their teammates.

8.2.2 Gender and games

The literature on games studies and gender includes research on the choice of game (e.g. [Royse et al., 2007](#), [Amory and Molomo, 2012](#)), motivations to play (e.g. [Yee, 2006a](#), [Yee, 2008](#), [Royse et al., 2007](#)), and the way that the genders are represented within games (e.g. [Eklund, 2011](#), [Royse et al., 2007](#)). [Eklund \(2011\)](#) examines the ways that women build, identify with and play their characters in *World of Warcraft*, focusing on the way they perform their gender online. [Williams et al. \(2009\)](#) examined several aspects of gender roles and behaviours among online gamers, specifically focussing on playing with a romantic partner and the effect this had on the level of aggression the player displayed, their social motivations for playing (e.g. play for the purpose of fostering and maintaining relationships), and their general happiness level (not purely gaming-related). The differences were measured in relation to players of the same gender who were not playing with a partner. They did find significant gender differences, with men reacting to playing with a romantic partner very differently to women: men's physical aggression increased, while women's decreased. Women who played with a romantic partner were less socially motivated (playing to maintain social relationships), while men's social motivation for play increased, and men's self-reported happiness levels were lower when playing with a partner, whilst women's increased. They do not specify the gender of the romantic playing partner, only the gender of the respondent, and their findings relate to general levels of

happiness rather than team cohesion or team member satisfaction.

Gender swapping in online games occurs when players choose avatars of a different gender to their own. Whilst this is not an area addressed in this investigation (the presence of all players in the same room rather limits the possibilities, as players are aware of the real life gender of the player even when their avatar is), it is an area of research worth exploring. Several studies (e.g. Martey et al., 2014, Lou et al., 2013) have attempted to isolate differences in the play style of players with different avatar types. In turn, this helps to identify the perceived differences in play style between genders. Lou et al. (2013) investigated a Taiwanese MMO called *FairyLand Online*¹, using anonymised data supplied by the developer (Lager Network Technologies) to do a detailed study of player behaviour in several different areas: levelling up², private one-to-one messaging, sustained social ties, and trade. Levelling up behaviour in particular suggested a different approach, with players playing female avatars in general taking a greater amount of game-time per level. This is in spite of no in-game difference in the abilities of male and female avatars. It is interesting that this behaviour hinges on the avatar gender rather than the player gender, and suggests that players may (subconsciously or otherwise) choose to mimic the way they perceive that gender playing. This implies there are recognisable differences in play style. Martey et al. (2014) investigated whether it is possible to identify the real life gender of a player through the actions of their avatar in-game in spite of this tendency. They examined three groups of players in a specially-designed quest in *World of Warcraft*: men playing male avatars, men playing female avatars, and contrasted these with women playing female avatars (apparently no female players chose to play as male during this study). They examined the avatar appearance, chat, and movement patterns of the players. They found that men playing female avatars adopted similar avatar appearances to female players, and to some extent adopted similar patterns of chat. However, movements were more similar to men playing male avatars. This implies that although there are some behaviours that players notice as being different or they would be unable to mimic them, other areas where the differences are more subtle.

This analysis suggests that there may be differences in playing style between women and men, but does not explore these in relation to teams.

¹See <http://fairyland.lagernet.com/> for more details.

²Levelling up is a term used by players to refer to the process of moving through the in-game levels.

8.2.3 Gender and Team Cohesion

What difference in team cohesion is therefore expected when teams comprise either all males or all females? A number of studies have consistently shown that women display much greater in-group bias (i.e. own gender preference) than men (Nosek and Banaji, 2001, Rudman and Goodwin, 2004). However, this was in the context of being asked to associate words with the generic idea of ‘men’ and ‘women’, rather than examining interactions within small groups of a particular sex. Research on men’s friendships suggests that the cultural definition of masculinity may lead them to keep other men at a distance (Garfinkel, 1992). There is some evidence that men in different cultures do have different understandings of what masculinity might mean, and this could lead to differences in the way that they relate to each other, and the types of issues that they choose to disclose (Roberts, 1994). Reisman (1990) compared men and women in Hungary and the United States, and found that in both cultures men and women found it easier to relate to women. Bradley (2007) suggests that men in the presence of other men are driven to ‘perform’ their gender in competitive ways “to maintain their place in the patriarchal pecking order”, and may behave quite differently in more private situations.

While there is some evidence to suggest that women who are successful in male-dominated environments may seek to distance themselves from other women (Ellemers, 2001), it was presumed that this would not be an issue in this present study as the teams were too small to make them ‘male-dominated’ and have enough women to distance from. Eklund (2011) found some evidence that female players in *World of Warcraft* were asked to play moderating roles in their guild, saying that the men were ‘better behaved’ when female players were around. King et al. (2009) report mixed findings on relations in diverse groups (which includes gender diversity): some studies show increased conflict in teams with diverse members, and SIT would also suggest that people are more likely to cooperate with those more like themselves (Tajfel and Turner, 1979). This appears to be particularly true in the early stages of team formation before a unifying group identity has been formed (King et al., 2009).

All of which taken together tends to suggest that all-female teams will report a higher level of cohesion than all-male, but leaves the position of the mixed teams unclear.

8.2.4 Gender and Team Member Satisfaction

Savicki et al. (1996a) found that the all-female groups reported a higher level of satisfaction with their group than either the all-male or mixed groups when performing group tasks

(resolving a series of moral dilemmas) using computer-mediated communication (CMC), although the definition of group satisfaction used is not stated in the paper. The results examined here will continue to use the same definition of team member satisfaction outlined in Section 2.5, which will be broken down into perceived conflict between the group goals and individual views of the group goals (mixed-motive), intra-team communication and perceived fairness of participation within the group.

Relating mixed motive to prior work on cooperation and conflict and gender, it has been shown that women employ cooperative behaviour in the Prisoners Dilemma game more than men, even when the gender of their co-player is unknown (Kümmerli et al., 2007). Additionally, it has been shown that women are more likely to change their views to match the group view (Adrianson 2001, Savicki et al. 1996a). These studies suggest that there will be less conflict between the goals pursued by the group and individual view of these goals in the all-female teams than in the all-male teams, and satisfaction will therefore be higher.

In addition to this there is evidence that from an early age men and women learn to socialise differently within same-sex groups. Interactions in groups of boys tend to be concerned with issues of dominance, whereas groups of girls use conversation more as a social binding process (Maccoby, 1990). There is some suggestion that all-female groups tend to agree more, whereas all-male groups have more frequent disagreements (Carli, 1989). Savicki et al. (1996b) found that in text-based computer-mediated communication, male-only groups demonstrated a tendency to talk ‘at’ each other, rather than ‘to’ each other. Lou et al. (2013) examined private communications in *FairyLand Online* and concluded that players were most likely to attempt to initiate private conversation with an avatar of the opposing gender to the one they were playing at the time. This was irrespective of the gender of the player. However, when they looked at patterns of ‘friendship’ (which they determine by examining the ‘friend list’ of the players, which needed to be approved by both players) they found a higher probability of friendship between players of the same gender – that is, female players were more likely to befriend other female players (regardless of the gender of their avatars), and male players were more likely to friend other male players. Also when they considered the duration of the private conversations, any conversation with a female player was likely to last longer, and female-player-to-female-player conversations lasted longest on average. These findings suggest that all-female groups are likely to communicate more than all-male groups, and potentially find communication easier.

Women are also more likely to pause to allow other people to have their say ([Maccoby, 1990](#)), which may contribute to people in groups with women (either all-female or mixed) feeling that participation was fairer. In a review of “social loafing” (where the effort and motivation of individuals is reduced in group situations, forcing other group members to do more than their fair share of the work) [Karau and Williams \(1993\)](#) found that social loafing was found to increase when the groups were all-male as compared to either mixed or all-female groups, which again suggests that participants in mixed or all-female groups would perceive a more even balance of effort.

8.2.5 Gender and Tactics

All of the games studied require the teams to make a series of decisions with incomplete information. The weather may or may not be perfect. In a given season, crops may get pests, which will reduce the yields, but is it worth the cost to take action to mitigate the effects (e.g. spraying pesticide)? The most nutritious diet may protect a family member from getting ill, but it also uses up more of the family’s reserves. Is it better to feed one’s family a mediocre diet, keep some crops in reserve and take the risk that some members may perish?

[Smith \(2006\)](#) proposes a ‘Rational Player Model’ that relates the idea of rationality from Game Theory to games. In this he presumes that every player (or team in this case) is rational, in the sense that they will choose to take actions or employ strategies that help them achieve the game goals, such as avoiding the ghosts in Pacman or attempting to hit the ball back into the court in tennis. If this model applies to the African Farmer Game we should not expect to see differences in strategy between male and female teams. However, the African Farmer Game provides no single explicit goal, meaning that each team may end up working towards a different goal, which in turn will affect their choice of strategies. Although many teams perceive the goal of the African Farmer Game as keeping the family alive, the game equally supports a wealth-maximisation strategy that may include actively reducing the number of family members the group is supporting. It may be that the team strategies will be in accordance with the Rational Player Model, yet still be very different depending on the goals set by the teams. This then begs the question of whether there will be differences in the team goals chosen depending on the gender of the players.

Instead of providing simple measurements of success and failure, the African Farmer Game is designed to confront the players with an environment that is rife with risks.

Team Composition	Number of females	Number of males
All female	20	—
Mixed	13	11
All male	—	16
Unknown	2	0
Total	35	27

Table 8.1: Number of men and women playing by team composition.

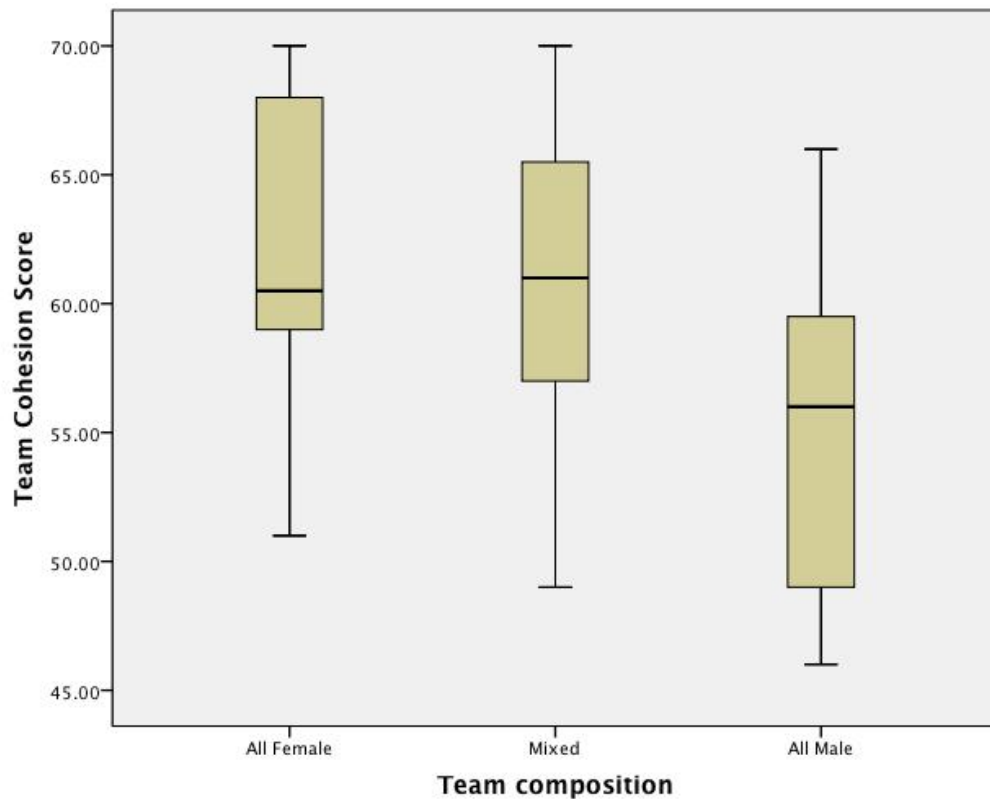
Decisions made in this environment have a potentially large impact on the health of players' in-game families. The literature on risk taking (see [Byrnes et al., 1999](#) for review, also [Croson and Gneezy, 2009](#)) suggests that women take fewer risks than men, even in relatively innocuous circumstances. This may suggest that there will be a difference between the female and male teams, with female groups potentially choosing to focus more on keeping the family members alive and therefore taking a more direct route to feeding their families than males. Within the African Farmer Game, the most risk-averse tactic would appear to be planting the crops that will directly feed the family and taking the best care of them (weeding) throughout the season, feeding the family as well as possible whilst saving some seed and possibly contingency for the following year. It may therefore be that all-female teams take this approach more than the all-male teams.

In summary it does appear that the composition of the teams will have some effect on both team cohesion and team member satisfaction. The research suggests that differences in the way that men relate to men and women relate to other women may indeed lead to differences in the way that the teams bond, and this may be reflected in the satisfaction with teammates in addition to the cohesion of the teams. The observed differences in risk-taking (approaches to risk) suggest some potential for differences in strategy.

8.3 Results

Table 8.1 presents the numbers of men and women who played any of the four games, and the composition of the groups they played in. Group gender composition is calculated by comparing the team names and the gender of the respondents. In two cases the participants did not write down a team name in the space provided; these are therefore excluded from calculations on team composition but are included in the general gender statistics.

Figure 8.1: Team cohesion scores by group gender composition.



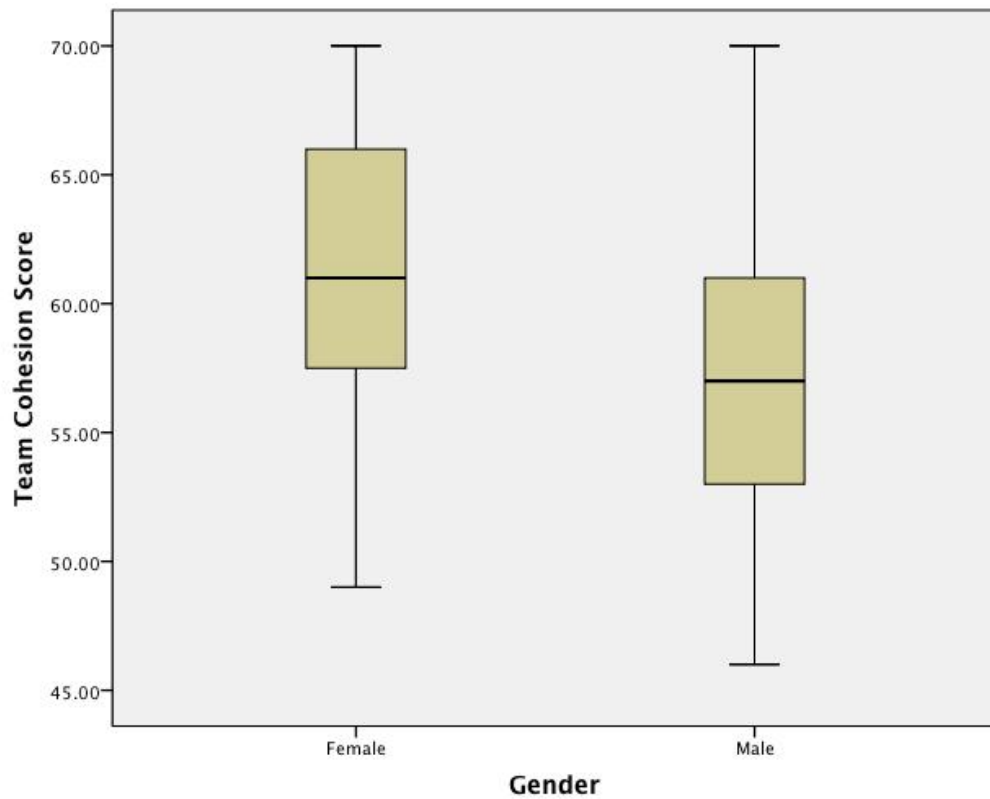
8.3.1 Team Cohesion

As shown in Figure 8.1, the median team cohesion score for all-female teams was higher than for all-male teams (60.5 as compared to 56.0). The mixed teams produced the highest median score for team cohesion at 61.0. The team cohesion score was significantly affected by the gender composition of the groups (Kruskal-Wallis, $H(2) = 10.55$, $p < .01$). Mann-Whitney tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a .025 level of significance. The all-male groups reported a significantly lower team cohesion score than the players in mixed groups ($U=94.0$, $r=-.43$). However, there was no significant differences in team cohesion between the all-female groups and the mixed groups ($U=214.5$, ns, $r=-.09$).

Figure 8.2 provides the median, maximum and minimum team cohesion scores by gender, regardless of the composition of the team that the individual was a part of. Female players reported a higher median team cohesion score (61.0 as compared to 57.0) than male players, and this was found to be significant (Mann-Whitney, $U=296.5$, $p < .05$, $r=-0.32$).

Although men in all-male groups reported a much lower median team cohesion score versus men in mixed groups (56.0 versus 60), this difference was not found to be significant at the 5% level ($U=48.5$, ns, $r=0.38$). However, the effect size suggests that there may have

Figure 8.2: Team cohesion score by player gender.



been a tendency for men in mixed groups to report a higher level of team cohesion. There was no significant difference between women in all-female groups and women in mixed groups ($U=122.0$, ns, $r=-0.05$). Comparing men and women in mixed groups produced no significant differences ($U=64.0$, ns, $r=-0.09$).

8.3.2 Team Member Satisfaction

Figure 8.3 shows the results for different team compositions for team member satisfaction and the sub-factors of mixed-motive, communication and fairness.

The overall team member satisfaction measure was significantly affected by the gender composition of the team (Kruskal-Wallis, $H(2) = 12.13$, $p < .01$). Mann-Whitney tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a .005 level of significance. The members of all-male teams ($N=16$) reported a significantly lower team member satisfaction compared to players in mixed teams ($N=24$) ($U=89.5$, $r=-0.45$), but there was no significant difference in the satisfaction reported by the all-female groups ($N=20$) as compared to the mixed teams ($U=225.5$, ns, $r=-0.05$).

The reported values for the sub-factors will be considered separately. The mixed motive measure was significantly affected by the gender composition of the team (Kruskal-Wallis,

Sub-factor	U	p	r
Mixed-motive	234.5	ns	-0.02
Communication	220.0	ns	-0.07
Fairness	211.0	ns	-0.10

Table 8.2: Results of Mann-Whitney tests between all-female team members and mixed team members on the three sub-factors of team member satisfaction.

$H(2) = 13.068$, $p < .01$), as was the communication (K-W, $H(2) = 6.946$, $p < .05$). However, the fairness rating was not significantly affected (K-W, $H(2) = 2.813$, ns). Following up on these results, for mixed motive there was again a significant difference between the members of all-male teams and mixed-team members (Mann-Whitney, $U=88.50$, $p < .005$, $r=-0.45$), as there was for communication (Mann-Whitney, $U=100.50$, $p < .025$, $r=-0.40$). Although the results of the fairness measure suggest that there is no significant difference, when the male team members were compared to the mixed team members (Mann-Whitney, $U=151.00$, ns, $r=-0.18$) there does appear to be a small effect produced.

There were no significant differences between female team members and mixed team members in any of the subfactors (as shown in Table 8.2).

Figure 8.4 provides the same four boxplots based on the gender of the player rather than their team gender composition. There is no significant difference in overall team satisfaction between male and female participants at the 5% level ($U=335.50$, ns, $r=-0.25$), although the medium effect size suggests that there may be some effect. The mixed motive measure did display a significant difference between the two groups ($U=313.50$, $p < .05$, $r=-0.29$), however that was the only subfactor to do so. Neither communication ($U=390.5$, ns, $r=-0.15$) or fairness ($U=413.5$, ns, $r=-0.11$) showed any significant difference.

There were no significant differences on any measure between women in all-female teams and women in mixed teams (Team member satisfaction: $U=116.0$, ns, $r=-0.10$, mixed motive: $U=125.5$, ns, $r=-0.03$, communication: $U=125.0$, ns, $r=-0.03$, fairness: $U=113.5$, ns, $r=-0.09$). However, the reported team member satisfaction in all-male teams was significantly lower than that reported by men in mixed teams ($U=35.5$, $p < .01$, $r=0.50$).

8.3.3 Team Tactics

Evidence for the team strategies is based, in the first instance, on the game logs, which are only available for the two online games (*Vanilla AFG* and *Expanded AFG*). The transcript of the whole group discussion provided an additional source of data, with participants

Figure 8.3: Box plots demonstrating the team member satisfaction ratings and subfactors by team composition.

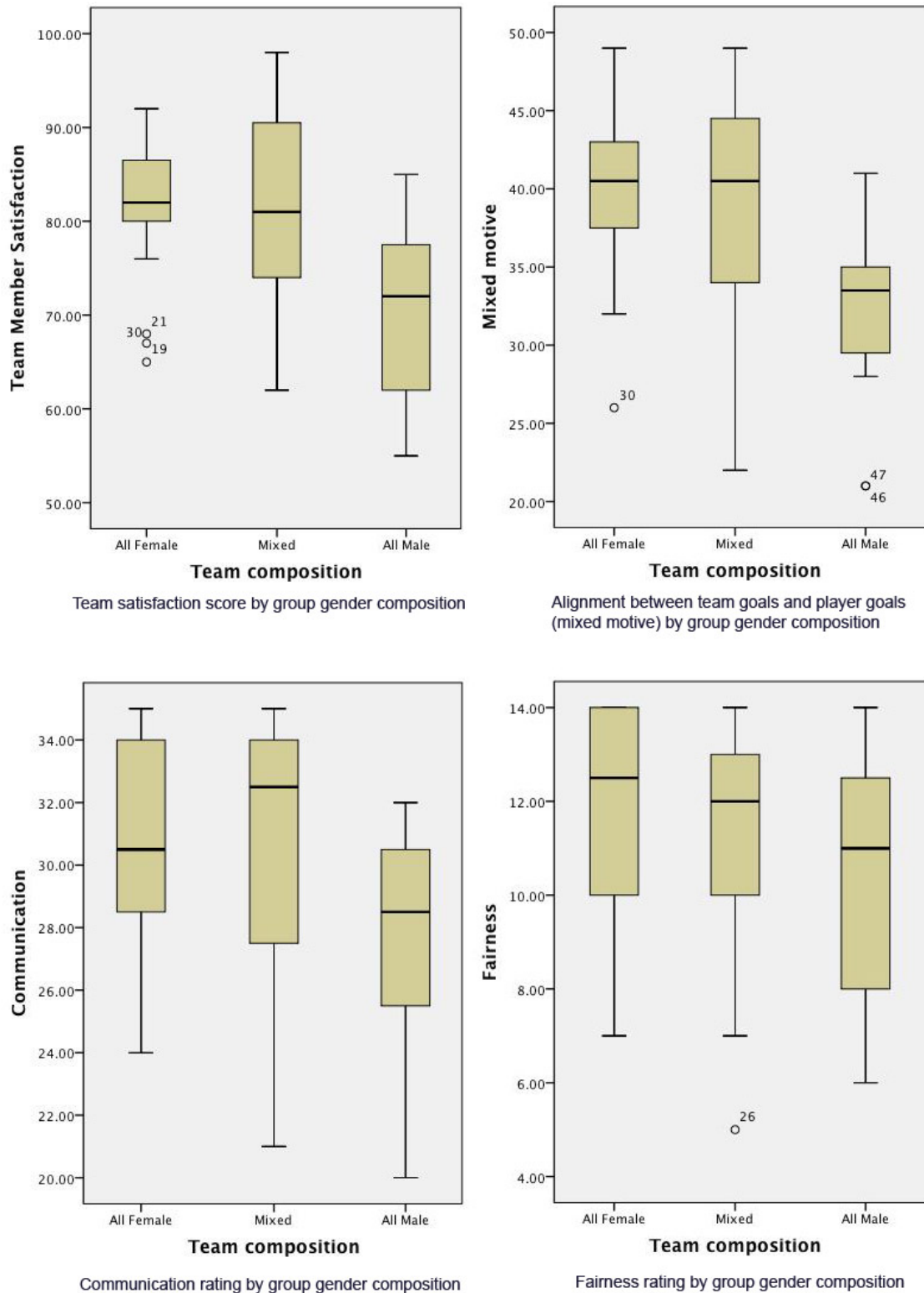
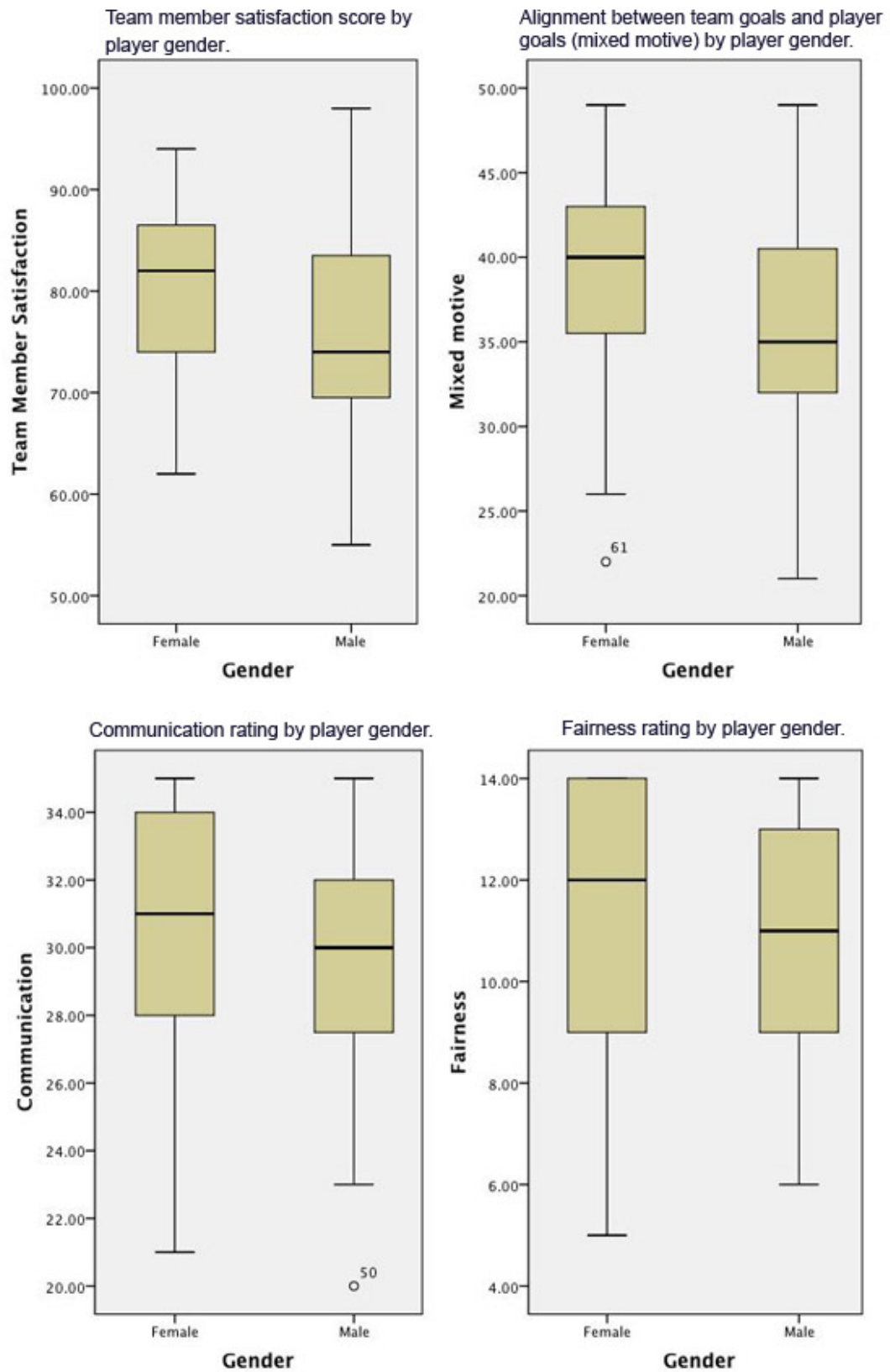


Figure 8.4: Box plots demonstrating the team member satisfaction ratings and subfactors by player gender.



frequently explaining the strategies they used, and the reasoning behind them. This allowed for triangulation of the quantitative game logs and the qualitative group discussion, and provided a richer picture of the differences in team strategies across genders. The results from each game will be discussed separately.

The game logs from each game provided information, for each team, on the number of fields planted, the crops planted in each field, and tasks carried out, with the latter providing information on the ways in which teams maintained their fields. Game logs were also able to capture transactions of goods between teams to a certain extent, however only the giver and the amount were recorded, not the particular item given or the recipient. These transactions were infrequent, with 11 attempts at giving recorded by 6 players in the *Vanilla AFG* and only 4 attempts recorded by 3 players in the *Expanded AFG*. Any communication between teams that took place verbally rather than through the in-game communication mechanisms was not recorded or captured, and was therefore unavailable for analysis.

All quotes from the reflective discussion in the sections below use pseudonyms. The mediated group discussions from the end of the two game sessions were recorded using a single device placed in the centre of the room. These recordings have been transcribed and the comments from these transcriptions have been used to illustrate the findings from the game logs. A full analysis of the discussions has not been performed due to time constraints — this could be an area for further work.

Vanilla African Farmer Game

There were seven teams in this game, four all-male and three all-female. A total of 28 fields were available for planting in the game. 14 of these were divided amongst the all-female teams, and 14 belonged to the all-male teams. Table 8.3 shows that the female teams consistently planted all of their available fields, while the male teams planted increasingly fewer fields as the game years progressed. Furthermore, female teams planted all of their fields with food crops in all years. The males, on the other hand, planted some cash crops in the first year, but in the remaining years planted only food crops and left increasing numbers of fields unplanted. The all-female teams were more diligent about weeding their fields and made fewer mistakes in task allocation (e.g. allocating too many jobs to a single family member, or attempting tasks when they did not have the necessary assets) that led to task failure. Two of the men's teams did not weed at all, despite being told that this would have serious consequences for their yield. One all-male team did not plant all

Game Year	Total Fields Planted		Total Food Crops		Weeded Fields		Failed Tasks	
	Female	Male	Female	Male	Female	Male	Female	Male
Year 1	14	12	14	10	13	4	1	3
Year 2	14	10	14	10	14	7	0	1
Year 3	14	8	14	8	9	3	0	0

Table 8.3: Annual comparison of fields planted and weeded by team composition in vanilla AFG

of their fields in any annual cycle.

The field-planting logs suggest that the male teams pursued different strategies to the female teams, a point which was confirmed in the post-game discussion. Three of the four male teams reported trying to grow cash crops, although one commented that sanity prevailed and they decided to revert to food production. This comment was made at the end of the game with the benefit of hindsight and after hearing of the experiences of other teams, as there is no reason why cash crops would not have been seen as a viable alternative.

Other strategies attempted by the all-male teams included selling labour, as indicated by a number of occurrences of this type of task in the game log and confirmed by the discussion (all of the logged attempts to work for other people took place in the first game year):

Fred (m): “We shift some labour there in the first year and we got a really good deal.”

Bob (m): “Yes I think some people bought labour from us but didn’t realise they didn’t need the labour... so the season passed without them using it. But they had already paid.”

One of the all-male teams reported attempting to negotiate loaning money to another team, although this could not be confirmed by the game logs:

Fred (m): “We also tried to lend money. We were just about to strike a deal with this family at 20% interest rate but the deal broke down at the last moment.”

The all-female teams noticed in the discussion that they all stuck to food production. This was confirmed by the game logs.

Facilitator: “And those of you who were taking more of the food security approach, focusing on staple crops or...”

Sally (f): “the women!”

Facilitator: “Yeah the women exactly.”

Expanded African Farmer Game

In this game there were six teams, of which four were mixed, one all-male and one all-female. There were 22 fields available for planting: fifteen of these were divided amongst the mixed teams, four belonged to the all-male team and three to the all-female team. Table 8.4 shows that again, the all-male team failed to plant all of the fields available to them until the final year, but they did take good care of the crops that they planted. The all-female team planted and weeded all of their fields consistently. The mixed teams did not manage to plant all of the fields available to them in any year, and did not weed as consistently as either the all-female or all-male teams in this game. They also made mistakes in allocating their tasks – one task failed due to insufficient stocks, and a second due to over-allocated labour.

The all-female team took a different approach to those in the *Vanilla AFG*, planting one field of cotton every year. They discussed this in the reflective discussion:

Sue (f): “We spread our risk by planting a different crop in each field. We went for cotton, which was good, we made lots of money in the first year.”

...

Sue (f): “We kind of tried to figure out what the nutritional value was relative to the cost and horticulture was really expensive to buy in the market so we tried to grow it ourselves, because maize was really cheap to buy in the market so we didn’t grow maize, so we sort of tried to balance it like that.”

Joan (f): “And I think just to add, we decided to go with cotton because it would stand most of the seasons and we made good money out of cotton so we just plant it and sold it all to buy things.”

The male team consistently planted food throughout, but did not plant all of their fields in the first year and planted one field late rather than early. Their approach appeared much more experimental than the all-female team. They described their approach throughout the seasons:

Brian (m): “Started out sending the youngest girl to school and spread crop sowing through early and late because we weren’t sure if meant anything. Um. But got a wide spread of crops in terms of not the cash crop but...”

Robert (m): “Horticulture, maize and beans.”

...

Brian (m): “We ended up... um... doing a bit of maths and calculation on the basis of the kind of food/nutrition balance working out what the bare minimum was. um. Giving up on horticulture entirely and focusing on beans and maize.”

The mixed teams demonstrated a wide range of approaches and experienced a range of different outcomes. Only one family planted cotton, and this group stated that they started with a lot of fields and were looking to make as much money as they could.

Diane(f): “yeah, and we had 5 adults and 4 children and we started with 150 Afris and 6 fields and our strategies started right from the proposal because I had 6 fields so I had to look for someone with lots of adults so I chose her.”

Facilitator: “So you married her because she had a big family, a big labour force.”

...

Will(m): “Yeah, so really we had the capital, we had the fields and we had the labour. So our strategy the whole game wasn’t to wonder how we were going to make ends meet, but uh, y’know, we wanted to reach the biggest amount of money we could reach. That was really our goal.”

This family also lent money successfully.

Diane (f): “Yeah, and we lent some money and...”

Facilitator: “So you lent some money as well?”

Diane (f): “Yeah we did.”

Facilitator: “And did you get that repaid to you?”

Rachel (f): “Plus interest”

Diane (f): “yeah we did plus interest”

Rachel (f): “20%!”

Game Year	Total Fields Planted			Total Food Crops			Weeded Fields			Failed Tasks		
	X	F	M	X	F	M	X	F	M	X	F	M
Year 1	13	3	3	10	2	3	13	3	3	1	0	0
Year 2	14	3	2	13	2	2	12	3	2	1	0	0
Year 3	13	3	4	11	2	4	12	3	4	0	0	0

Table 8.4: Annual comparison of fields planted and weeded by team composition in Expansion AFG (X=Mixed, F=All-female, M=All-male)

Diane (f): *laughs* “At 20% which is lower than most microfinance and yeah...”

However, this family stood out amongst the mixed teams. The other families followed food-based planting strategies.

8.3.4 Team Outcomes

Although the outcome for the team is difficult to define given that the only information we have on team goals comes from the discussion session at the end and, as such, is incomplete, it is still useful to consider some measure of team performance. The final worth of the families and the final number of family members provide useful metrics for gauging the comparative success of the teams. These metrics are produced from the game logs built into the online games, which allow greater detail to be gathered than from the face-to-face games. Overall the outcomes for the female teams were significantly better than those of the male teams by these measures, with fewer household fatalities and greater final assets. The players were asked at the end of the game to sell any of their remaining assets back to the market. The final asset count is measured in the amount of in-game currency they had once this had been done.

Vanilla African Farmer Game

All of the male teams lost multiple household members, so much so that in some cases “reincarnation” was required so as to allow teams to continue to play the game. The female teams experienced a significantly lower mortality rate, although some deaths did

Household Name	Team Composition	Number of Fields	Initial Household Size	Final Household Size	Final Asset Count
Nyanya	Female	3	5	7	19
Ndizi	Female	4	7	9	55
Mboga	Female	7	10	2	10
Kiazi	Male	5	9	3 (2 reincarnated twice)	0
Matunda	Male	3	6	0 (2 reincarnated)	0
Kabichi	Male	3	5	0	0
Nanasi	Male	3	7	3	0

Table 8.5: Team gender, number of fields, initial and final family sizes and final asset count for the vanilla African Farmer Game.

occur. All of the female teams had at least some assets remaining at the end of the game, compared to the male teams, none of whom had any assets remaining. Table 8.5 provides the figures for the relative starting and finishing points of the teams.

Expansion African Farmer Game

The majority of the teams in this game were in a better position by the end of the game than those in the Vanilla AFG. Table 8.6 shows that the male team did lose household members, and although they finished the game with some assets they were still far from being secure. The female team lost no household members, managing to increase the size of their family during the game. They were also in a better position in terms of the assets for the following year.

The mixed teams show a wide range of results. The Kabichi family managed to maintain their family and amass a considerable amount of assets. The other three groups, however, were not in such a strong position, all having lost some members of their families and being far from comfortable for the following year.

Household Name	Team Composition	Number of Fields	Initial Household Size	Final Household Size	Final Asset Count
Kabichi	Mixed	6	9	9	767
Kiazi	Mixed	3	5	4	0
Mboga	Mixed	3	8	9	20
Nanasi	Mixed	3	6	3	26
Ndizi	Male	4	5	3	14
Nyanya	Female	3	6	7	84

Table 8.6: Team gender, number of fields, initial and final family sizes and final asset count for the expanded African Farmer Game.

8.4 Discussion

We examined whether the team cohesion, team member satisfaction and game strategies would vary between all-female and all-male teams. We found that all-female and mixed teams reported higher levels of team cohesion and team member satisfaction than all-male teams. Whilst there was a significantly higher team cohesion reported by female players than male players regardless of the team composition, there was no significant difference found in the team satisfaction reported by male and female players. In terms of team tactics and outcomes, the all-female teams generally appear to have followed a risk-averse route of planting food and making sure the family were fed, whereas the all-male teams appear to have been much more experimental. This had an effect on the outcomes, with the all-female teams tending to finish the game in a stronger position than the all-male groups.

Previous research suggests that girls begin playing in small, cooperative groups from an early age and continue this through to adulthood, becoming increasingly comfortable collaborating within small groups (Maccoby, 1990). Maccoby (1990) also suggests that men, on the other hand, act more competitively as boys and continue to have a competitive element even in their friendships (Garfinkel, 1992). This may make them less inclined to identify with the group and make their teams less cohesive. The results of this study supports those findings, in that the team cohesion scores were significantly higher in the female teams and this difference showed a large effect size. These findings do seem to confirm that women really do like women more than men like men (Rudman and Goodwin, 2004)!

It is interesting that the mixed groups reported a higher cohesion than the all-male groups but was not significantly different to the all-female groups. This perhaps suggests that men are more prepared to identify with the group when working with women than with men, whereas women appear to make less of a distinction. This supports the notion of men needing to behave differently in groups of men than with women (Bradley, 2007), and perhaps of a cultural definition of masculinity which makes it difficult for men to bond (e.g. Garfinkel, 1992, Reisman, 1990). The participants in this study represented a wide range of nationalities and therefore potentially cultures, suggesting that this effect may be cross-cultural.

Although the team cohesion reported by men was significantly lower than that reported by women regardless of the gender composition of the teams, the difference between the cohesion reported by men in mixed teams was not found to be significantly higher than their counterparts in all-male teams. However, the effect size associated with this result does suggest that there may be a difference, which may be confirmed with a greater number of participants.

It may be noteworthy that the all-male teams generally appear to have finished the game in the worst position. Given that the players were not given feedback on the other families it is difficult to say how aware they were of their relative position amongst the group, but it is possible that – given that family members were dying – this contributed to feelings of low team cohesion. Anecdotally throughout the game players tended to underestimate their success, even when their team was doing well, so it would be interesting to gather information about the players' perceptions of their team's standing.

The reported team member satisfaction ratings followed much the same pattern as the team cohesion scores, with mixed and female teams being significantly different to male teams, but not significantly different to each other. There were large effect sizes for two of the three subfactors, with conflict between group and individual goals being significantly higher for all-male teams and communication rated lower. This again supports the findings in the literature, which suggested that women were more likely to collaborate than men (Kümmerli et al., 2007) and were more likely to communicate well (e.g. Maccoby, 1990, Lou et al., 2013).

It would be interesting to follow up on male/female differences with respect to ease of communication by looking more closely at the volume and type of communication that the teams used. In the setup used in this study players had the option of using the computer-mediated communication methods offered by the game but could also commu-

nicate verbally. Participants tended to communicate verbally with their teams, given that they were seated at the same table. However, there was some evidence of certain teams using the in-built communications when they were negotiating with other families. Given the use of communication channels both inside and outside of the game, it was not possible to measure the full extent of communication that took place during the game. There was anecdotal evidence that in some of the male teams, communication was very limited and appeared to be causing problems at times (e.g. in one group a team member spent the household money without consulting his teammate). Communication issues such as these did not appear to cause difficulties in the female teams or the mixed teams, although this is based on observational data and, as such, is subjective.

The fairness rating showed no significant difference between the three types of group. This may have been due to the size of the groups studied, which are mostly groups of two and three. [Karau and Williams \(1993\)](#) found that social loafing decreases with group size, being less prevalent in smaller groups.

The team's gender composition was also associated with differences in strategy. Male teams appeared to initially pursue more varied, and potentially more risky, strategies, but this cost them dear in terms of family members. These initial schemes used their financial resources without providing adequate returns, and meant that either family members died immediately or they had too few resources left to regroup the following year. The female teams were more conservative, but this paid off in terms of the survival of their family members, and two of the teams were able to successfully build (in terms of using better seed and fertiliser to increase their yields, or improving the family diets) in later years.

The strategies used by the female teams all centred on a food production strategy. They planted all of the fields available to them, and weeded diligently. The all-female team in the *Expansion AFG* did choose to plant cotton, but it was clear when they were asked to describe their strategy that they had very carefully weighed up the relative benefits in terms of both cost and nutritional value of each crop, and had made what seemed to them to be the best decision in order to keep their family fed.

The male teams showed a wider range of tactics, with some food production but also some cotton being planted instead of food, and attempts to send their family members to labour for other families for money. They were less diligent in weeding their crops, and seemed to make more mistakes in allocating labour and assets than did the women. They appeared happier to experiment with their crops, with less concern for the outcomes.

Although it is not possible from this study to determine with complete accuracy why

there was such a marked difference in strategies pursued, the results are in line with previous studies that suggest that women are more risk averse than men (Byrnes et al., 1999) even in a low-stakes environment such as this. Therefore the women grow crops and take better care of them than the men, who were less careful. However, it may also be that the context of this game reinforced traditional gender roles by asking the players to work in a “family” setting. The stereotypical gender roles in this environment are that the men “work” (in this case, attempt to earn money to buy food) and women take responsibility for the family (attempt to provide food directly) (Guttek et al., 1991). However, we do not currently have any data that explores the extent to which participants identified with their gender out of the game or attempted to take on the in-game gender role, which may have been different to their own. This would have been meaningful in *Africulture* as well as the two online games, and may have had some effect on the behaviour of the players. The players did indicate some awareness of it, and would often use the “wrong” pronoun (e.g. “he” whilst indicating their female colleague) in the discussion at the end. Some seemed to take a certain level of delight in assigning household tasks to their “husbands”! This may be an interesting area for future study.

There is some evidence of one of the all-female groups in the vanilla AFG changing tactic in the third game year, perhaps as a result of guessing that it was the final year due to time constraints. The strategy pursued was riskier – they planted late rather than early and did not weed – and it was this that cost them 13 of their by then 15 family members. One of the all-male teams ran out of resources at the start of that year also, and rather than request a loan or gift from the game manager they chose to let their family die. This suggests that at this point they did not believe there were further consequences to doing so. This highlights the importance of disguising the last cycle of the game so as not to unduly influence strategy. In this study, ignoring the final year of the game in the results would have actually increased the differences between the male and female teams, as the female teams started to pursue riskier strategies.

The mixed teams displayed no dominant strategy. Some were quite risk averse, others were more experimental. It could be said that the range of strategies demonstrated is closer to the approach of the all-male teams, but this would need further study.

8.5 Chapter Summary

This chapter presented the analysis of data with respect to the gender of the participants and the gender composition of the teams formed in all four games. In general, female

players reported a significantly higher team cohesion rating than the male players, although no significant difference in team member satisfaction ratings was found. The all-female and mixed teams showed no significant differences, but both reported significantly higher team cohesion and team member satisfaction ratings than all-male teams. The tactics employed by the teams in the online games were explored, and it was found that all-male teams appear to use riskier, more exploratory approaches than all-female teams. These results were placed into context with other research on gender.

The next chapter will pull together the results presented across the thesis. Key contributions and conclusions are presented, along with reflections on useful future work relating to this area.

Chapter 9

Conclusion

The previous chapters have explored factors which may affect team experience in games, focusing predominantly but not exclusively on factors which are within the power of a game designer to affect. Although the results have been related back to the research questions as they have been presented, this chapter will summarise these. The key contributions of the thesis are then discussed, followed by some of the limitations of this work and areas of interest for future work.

9.1 Research Questions

The research questions posed in Chapter 1 have been referred to throughout the thesis. In this section the answers are recapped and summarised.

RQ1: To what extent do the real-world findings from Social Identity Theory translate to game worlds? What effect does changing the game rules have on the team cohesion levels reported by the players?

This question was considered in Chapters 4 and 6. The analysis performed in these chapters suggests that game rules can recreate situations found in non-game group situations. Group permeability and group formation are easily altered, and both have previously been shown to affect cohesion (Ellemers, 1993, Ellemers et al., 1999). Whilst it is more complicated to confirm the manipulation of the players' salient identity, the combination of in-game rewards and interaction design was shown to be emphasising either the individual or the team. In previous work on Social Identity Theory this has been shown to affect the group cohesion reported by individuals (Reicher et al., 1995).

Chapter 4 demonstrated a significant difference in the team cohesion ratings reported by the players in the two face-to-face games, with *Africulture* producing a lower level of

team cohesion ratings than the *Green Revolution Game (GRG)*. This was in the direction predicted by the analysis of the game rules.

However, in spite of the attempt to replicate the rule differences between the two tabletop games in the two online games, the difference in reported team cohesion was not seen in these games. In Chapter 6 it was suggested that this was due to some differences in the game design, caused in part by the requirements of the online setting. This suggests room for further work in this area.

RQ2: How does the level of in-group identification reported relate to team member satisfaction?

The data presented in Chapter 7 showed that there was a strong positive correlation between the measure of in-group identification and the overall team member satisfaction measure across all four of the studies. It appears that, by these measures at least, a high level of team cohesion and feeling satisfied with the team go hand in hand.

RQ3: What is the effect on both team cohesion and team member satisfaction of moving the game from a face-to-face to an online condition?

The results from both online games are compared to those played face-to-face in Chapter 7: no significant differences were found in the levels of team cohesion or team member satisfaction reported by the players of the four games. This suggests that overall, the two situations are engender similar levels of team cohesion and satisfaction. However, the lack of significant difference between the team cohesion levels reported in the online condition (see Chapter 6) when a significant difference was found between the face-to-face games (Chapter 4) suggests that there are some important differences between mediums.

The affordances provided by the physical nature of a tabletop game require more thought than ‘simply’ recreating the rule set in an online environment. This is obvious when porting, for example, football – the laws of physics controlling the flight of the ball are an extra set of rules which require writing into an online environment. However, it is less obvious with the translation of a board game. What do the pieces signify for the players? Even the identification of another individual – straightforward when in the same room – becomes more difficult when online. Some decisions made for expediency may have a complex effect on the salience of the identity of the individual over that of the group member, and result in lower levels of group cohesion as an unexpected and potentially unwanted side-effect.

In terms of the research question, it appears that moving to the online condition reduced the difference in team cohesion and team member satisfaction between the two

sets of rules. It is unclear whether this is due to differences in the implementation of the rules due to the game design, or due to the change in context. This difficulty is partly due to the different games used within the studies — using the variants of the same game would have reduced the variables here.

RQ4: How do more individual factors such as the players self-reported preference for group work or the number of people they know in their team affect the team cohesion and team member satisfaction as reported by the player?

Chapter 7 examined the relationship between these individual factors and the reported team cohesion and team member satisfaction. No correlation between team cohesion and either preference for group work or the number of the team members known was found. The picture was more complicated with team member satisfaction, with a correlation found with preference for group work. Those who expressed a preference for group work reported a significantly lower level of team member satisfaction than those who said that it depended on the situation. The sample size for the group claiming to always prefer to work alone was too small for any statistics to be produced. Further work is needed to confirm the validity of this result. There was no correlation between number of the group known and team member satisfaction.

In addition to these individual characteristics, gender was found to have a significant effect on the team cohesion reported – as explored in Chapter 8. In fact, team gender composition (all-female, mixed or all-male) was found to have the largest effect on the team cohesion of all of the factors explored in this thesis, with players in all-male teams reporting a significantly lower team cohesion level than those in mixed or all-female teams.

9.2 Contribution

The main contributions of this thesis are described in the following sub-sections:

9.2.1 Evidence that players' attitudes towards their teams within the game context can be somewhat predicted based on the rules of the game

The results from the two board games in Chapter 4 demonstrate that it is possible to predict the relative levels of team cohesion reported by the players based on an application of Social Identity Theory to an analysis of the rules of the game. This appears to be regardless of the personalities of the players involved in the game although the players' personalities remained relatively unexamined within the studies. Of course, this is the

average team cohesion across all players — there are no guarantees that a team will bond. However, it appears that some game designs and mechanics are more conducive to team cohesion than others.

9.2.2 Evidence of a relationship between team member satisfaction and team cohesion in a game

In this thesis the relationship between the satisfaction of the team members with their group membership and the cohesion they felt with their teammates has been explored. As discussed in Section 2.5, the definitions of team member satisfaction used in the literature have varied, and the relationship with team cohesion is unclear. The work presented here has added to both by presenting a working definition of team member satisfaction, and demonstrating a positive correlation between this measure and team cohesion.

9.2.3 Evidence of the differences in team cohesion caused by the team gender composition

Although unforeseen, the evidence examined in Chapter 8 suggests that the gender composition of the teams had a substantial effect on the team cohesion reported by the individual players across all four games. The addition of one or more female players to any team appears to increase the team cohesion for all players, and likewise the team member satisfaction. This finding adds to the body of work on teams and the effect of gender composition. It also suggests that games designed without consideration for players of both sexes may not only be missing out on a substantial market, but may also be causing their players to be less satisfied with their teams within the game, and potentially abandon the game more quickly as a result.

9.2.4 An online game for further exploration of team effects

The African Farmer Game (AFG) is an open source game, designed and built in such a way as to make it possible to quickly and non-destructively create new variants on the basic ruleset. The game was written using common technologies, and all source code is available for use at <https://github.com/africanFarmerGame/afri-farmer-multiplay>. All of the components of the client-server architecture are available without cost. This could be a powerful tool for those who wish to take this research further. Further information on the game can be found at <http://www.africanfarmergame.org/>, with a compiled download and playing instructions available for those who wish to play the existing game.

9.3 Limitations and Further Work

Throughout the course of this work many interesting opportunities for further work have presented themselves, but time has not allowed for their exploration. The studies themselves also contain some limitations. Both are discussed in the following sub-sections.

9.3.1 Use of a Single Game

One of the most obvious limitations of this thesis is the use of different games for the studies. This was a pragmatic decision: there was not enough time to build four variants of a single game that could be guaranteed to provide the experience that the participants had been promised. The decision was therefore made to use the existing boardgames. One possible avenue for further work could therefore be to translate the *African Farmer Game* (AFG) back into a board game. The calculations involved would be complex, but the game manager could perhaps use a computer to complete those and return the results to the players.

9.3.2 Different Players

A second limitation is the use of different groups of players for each game. Although ecologically sound, and again, done for pragmatic reasons, it still is impossible to discount the innate differences between groups from accounting for some (or perhaps all) of the differences in the team cohesion levels reported. The difficulty would be in designing an experiment that used the same group but revealed differences in team cohesion after the different games. It is not clear whether in this case the teams would also need to stay the same, but given the effects of time in increasing team cohesion, this route may not be practical even making allowances for ordering effects. With different teams within the same group the problems with validity resurface. It may be that the best solution would be to simply run further studies between groups.

9.3.3 Co-located Versus Remote Players

A further obvious question relates to the difference between the team cohesion reported by teammates in visual touch (albeit using their own computers) and that between players who are unable to see one another. This was not possible to explore in the current thesis, given the early stage of development of the software and the potential need for real-time, face-to-face assistance.

Having players in separate locations would also allow for a further extension to the gender element of the studies. With players able to see one another, the ability to “gender-switch” (where a player is represented in the game by an avatar of the opposite sex) is not possible. Although there is no difference in game-play between a male and female avatar, there was anecdotal evidence to suggest that the players were aware of differences in avatar gender and allocated work differently as a result. The research on gender-switching in online games highlighted earlier in Chapter 8 (e.g. [Lou et al., 2013](#), [Martey et al., 2014](#)) supports this finding. It would be interesting to examine the effect of gender-switching both on the reported team cohesion and on the tactics employed by the team.

This experiment could be performed with the same version of *AFG*, which would avoid the problems of having multiple games. Combining this with the use of a board game version as suggested above could potentially yield three separate contexts for comparison.

9.3.4 Redesigning the Online Game Variants

Chapter 6 found no significant differences in the levels of team cohesion reported in the course of the two games. Some suggestions were made that some of the design decisions made may have unintentionally reduced or altered the effect being targeted for investigation. For example, requiring players to log in with a unique name may have increased their individual salience in *Vanilla AFG*, whilst providing the partners with different information on the family progress in *Expansion AFG* appears to have helped the players to form a more cohesive team.

It would be interesting to return to the design of the two online games and attempt to redesign the elements in the online games that appear to have unintended influence over player behaviour, and see if it is possible to engineer a more significant difference between the two games. Some of these issues (e.g. the unique log in) could pose an interesting design challenge for an online game scenario.

9.3.5 Greater Focus on Individuals

The focus on the effect of game rules on the aggregate team cohesion levels misses the opportunity to gain further insights into the role of personality in the experience of team membership. This was a deliberate decision based on the time and resources available. As a result the questions around the individual were really extremely basic in the survey instrument. There are a number of different directions this could be taken in.

The measure of gender used in this study was very crude, really a simple measure of

sex. It would be interesting to use a broader measure such as the Bem Sex Role Inventory (BSRI) (Bem, 1974). However, Bem herself states that this measure was focused on the American cultural understanding of femininity and masculinity (Bem, 1979), whereas the groups of players in these games were from a wide range of cultural and geographical backgrounds. With hindsight, it would have been useful to record these cultural backgrounds — not necessarily to directly examine the effects of culture on the dependent variables so much as to demonstrate the range of nationalities in the sample and reduce assumptions of cultural bias on the effects seen. Although the validity of the construct of gender used in the BSRI is suspect in this wider context due to the lack of input of different cultural views of femininity and masculinity, it may still show some interesting results.

Alternatively the preference for group work measure could be expanded upon, perhaps with a measure of the full Individualism-Collectivism construct (Wagner III, 1995). Although no significant differences were found in this study as a result of the preference for group work reported, it may be that a wider selection of participants and a more detailed measure of personality may add to the findings.

Other areas on individual differences offered for further studies would include widening participation to students of other disciplines. Although the game was intended for use with students of International Development Studies, as used in these studies, some interesting differences in approach were uncovered during early testing with a more technical audience. There also seemed to be some difference in the ease with which players got to grips with the game, perhaps due to differences in gaming experience as the game uses familiar elements from other games. This was not part of the survey instrument but may be of interest to those who wish to examine the social effects of gaming.

9.3.6 Improve the Instrument for Team Member Satisfaction

Although the analysis of the survey instrument performed in Section 3.3.2 showed a good reliability for the measure of Team Member Satisfaction, there was not the time available to do a full factor analysis and process of improvement on the sub-factors. This work would have been invaluable, putting the findings on a much sounder footing and increasing the confidence in the output. A decision was made early in the design process to alter one of the factors found in the literature from perceived progress towards the group goal to conflict between group and individual goals. This decision is not without its problems, specifically because it distances this work from previous work done on the area of team member satisfaction. However, once that decision had been made it was imperative to

maintain the consistency of the questionnaire across all four studies. The fairness sub-factor would also potentially benefit from further work and potentially expanding within the instrument.

Team member satisfaction, or the “sense of fulfilment with the group experience” (Anderson and Martin, 1995), appears to have somewhat played second fiddle to the investigation of the individual’s satisfaction with the outcomes of the group experience. It would be interesting to look more closely at this metric, as with games the process of playing is often at least as enjoyable and important as the outcome!

9.4 Closing Remarks

This thesis has explored a range of game design elements and individual factors relating to team cohesion and team member satisfaction. The game design elements included rules and the implementation of those rules, and suggests that careful game design could create a game that encourages team bonding and increases team member satisfaction during the course of the game.

The examination of the game rules through the framework of Social Identity Theory suggests that this linking of game rules and social science may be a fruitful direction for further investigation. Although some types of games have been used in social psychology experiments for years this experiment has reversed the direction of the link between the two, attempting to use the findings from social psychology in game design. Perhaps with further investigation, it is to be hoped that this will help to strengthen the understanding of the ways that game rules and players’ responses interact.

Bibliography

- Adrianson, L. (2001). Gender and computer-mediated communication: group processes in problem solving. *Computers in Human Behavior*, 17(1):71–94. [94](#)
- Amory, A. and Molomo, B. (2012). Gendered Play and Evaluation of Computer Video Games by Young South Africans. *Gender, Technology and Development*, 16(2):177–196. [91](#)
- Anderson, C. M. and Martin, M. M. (1995). The Effects of Communication Motives, Interaction Involvement, and Loneliness on Satisfaction: A Model of Small Groups. *Small Group Research*, 26(1):118–137. [20](#), [22](#), [120](#)
- Anderson, J. R. (2005). The Relationship Between Student Perceptions of Team Dynamics and Simulation Game Outcomes: An Individual-Level Analysis. *Journal of Education for Business*, 81(2):85–90. [12](#), [22](#)
- Ashforth, B. E. and Mael, F. (1989). Social Identity Theory and the Organization. *The Academy of Management Review*, 14(1):20. [20](#), [88](#)
- Avedon, E. M. T. C. and Sutton-Smith, B. C. U. (1971). *The Study of Games*. John Wiley & Sons, Inc., New York, New York, USA. [8](#), [11](#)
- Barczak, G. and Wilemon, D. (2001). Factors influencing product development team satisfaction. *European Journal of Innovation ...*, 4(1):32–36. [22](#)
- Bell, D. C. (1975). Simulation Games: Three Research Paradigms. *Simulation & Gaming*, 6(3):271–287. [11](#)
- Bem, S. (1979). Theory and measurement of androgyny: A reply to the Pedhazur-Tetenbaum and Locksley-Colten critiques. *Journal of Personality and Social Psychology*, 37(6):1047–1054. [119](#)
- Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology*, 42(2):155–62. [119](#)

- Berland, M., Lee, V., and DuMont, M. (2010). Small Groups , Big Mistakes : The Emergence of Faulty Rules During a Collaborative Board Game. In *ICLS '10 Proceedings of the 9th International Conference of the Learning Sciences - Volume 2*, volume 2, pages 397–398. [23](#)
- Berry, G. R. (2011). Enhancing Effectiveness on Virtual Teams: Understanding Why Traditional Team Skills Are Insufficient. *Journal of Business Communication*, 48(2):186–206. [25](#)
- Bonebright, D. a. (2010). 40 years of storming: a historical review of Tuckman’s model of small group development. *Human Resource Development International*, 13(1):111–120. [15](#)
- Bradley, H. (2007). *Gender*. Polity Press, first edition. [91](#), [93](#), [109](#)
- Bull Schaefer, R. a. and Erskine, L. (2012). Virtual Team Meetings: Reflections on a Class Exercise Exploring Technology Choice. *Journal of Management Education*, 36(6):777–801. [25](#)
- Butler, B., Sproull, L., Kiesler, S., and Kraut, R. (2002). Community effort in online groups: Who does the work and why? *Leadership at a distance: Research in technologically supported work*, pages 171—194. [11](#)
- Butler, J. (1999). *Gender Trouble*. Routledge, second edition. [91](#)
- Byrnes, J. P., Miller, D. C., and Schafer, W. D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin*, 125(3):367–383. [96](#), [111](#)
- Campion, M. A., Medsker, G. J., and Higgs, C. A. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work groups. *Personnel Psychology*, 46(4):823–851. [23](#)
- Carli, L. L. (1989). Gender differences in interaction style and influence. *Journal of Personality and Social Psychology*, 56(4):565–576. [94](#)
- Chambers, R. (1981). Rural Poverty Unperceived: Problems and Remedies. *World Development*, 9(1):1–19. [12](#)
- Chang, Y.-L. B. (2012). Improving awareness of automated actions within digital tabletops. *Proceedings of the 2012 ACM international conference on Interactive tabletops and surfaces - ITS '12*, page 283. [24](#)

- Chapman, G., de Zeeuw, H., and Jiggins, J. (1993). Africulture. [4](#), [13](#), [27](#), [37](#), [49](#)
- Chapman, G. and Dowler, E. (1982). The Green Revolution Game. [4](#), [12](#), [27](#), [37](#), [49](#)
- Cohen, E. G. (1994). Restructuring the Classroom: Conditions for Productive Small Groups. *Review of Educational Research*, 64(1):1–35. [11](#)
- Croson, R. and Gneezy, U. (2009). Gender Differences in Preferences. *Journal of Economic Literature*, 47(2):448–474. [96](#)
- Ducheneaut, N., Yee, N., Nickell, E., and Moore, R. J. (2006). "Alone together?" Exploring the Social Dynamics of Massively Multiplayer Online Games. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '06*, number March 2005, pages 407–416, New York, New York, USA. ACM Press. [8](#), [9](#)
- Ducheneaut, N., Yee, N., Nickell, E., and Moore, R. J. (2007). The Life and Death of Online Gaming Communities: A Look at Guilds in World of Warcraft. In *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '07*, pages 839–848, New York, New York, USA. ACM Press. [10](#)
- Dunnigan, J. (2000). *The Complete Wargames Handbook*. Third edit edition. [11](#), [24](#)
- Egenfeldt-Nielsen, S. (2006). Overview of research on the educational use of video games. *Digital Kompetanse*, 1(3-2006):184–213. [11](#)
- Eklund, L. (2011). Doing gender in cyberspace: The performance of gender by female World of Warcraft players. *Convergence: The International Journal of Research into New Media Technologies*, 17(3):323–342. [91](#), [93](#)
- Ellemers, N. (1993). The Influence of Socio-structural Variables on Identity Management Strategies. *European Review of Social Psychology*, 4(September):27–57. [18](#), [19](#), [30](#), [41](#), [76](#), [113](#)
- Ellemers, N. (2001). Individual Upward Mobility and the Perceived Legitimacy of Inter-group Relations. In Jost, J. T. and Major, B., editors, *The Psychology of Legitimacy*, chapter 9, pages 205–222. Cambridge University Press. [93](#)
- Ellemers, N., Kortekaas, P., and Ouwerkerk, J. W. (1999). Self-categorisation, commitment to the group and group self-esteem as related but distinct aspects of social identity. *European Journal of Social Psychology*, 29(2-3):371–389. [3](#), [19](#), [41](#), [76](#), [113](#)

- Fox, R. C., Assmo, P., and Kjellgren, H. (2007). Role Playing African Development : an International Comparison. In *Fourteenth International Conference on Learning*, pages 1–12, Johannesburg, South Africa. [49](#)
- Garfinkel, P. (1992). Male Friendship: No-Man’s-Land. In *In a Man’s World: Father, Son, Brother, Friend, and Other Roles Men Play*, chapter 5, pages 91–116. Ten Speed Press, Berkeley, CA, first ten edition. [93](#), [108](#), [109](#)
- Gersick, C. J. G. (1988). Time and Transition in Work Teams: Toward a New Model of Group Development. *Academy of Management Journal*, 31(1):9–41. [15](#)
- Gladstein, D. (1984). Groups in context: A model of task group effectiveness. *Administrative Science Quarterly*, 29(4):499–517. [22](#)
- Gutek, B. a., Searle, S., and Klepa, L. (1991). Rational versus gender role explanations for work-family conflict. *Journal of Applied Psychology*, 76(4):560–568. [111](#)
- Gutschera, K. (2009). Characteristics of multiplayer games. *White paper presented at Game Developers Conference*, pages 1–22. [7](#)
- Harrison, D., Price, K., and Bell, M. (1998). Beyond relational demography: Time and the effects of surface-and deep-level diversity on work group cohesion. *Academy of Management Journal*, 41(1):96–107. [19](#)
- Hartman, J. J. (1981). Group Cohesion and Self-Esteem. In Kellerman, H., editor, *Group Cohesion: Theoretical and Clinical Perspectives*, chapter 16, pages 255–267. Grune & Stratton, Inc., New York, New York, USA. [16](#)
- Hogg, M. A. (2006). Social Identity Theory. In Burke, P. J., editor, *Contemporary social psychological theories*, chapter 6, pages 111–136. Stanford University Press. [17](#)
- Hogg, M. A. and Abrams, D. (1988). *Social Identifications: A social psychology of inter-group relations and group processes*. Routledge, London. [15](#)
- Huddy, L. (2001). From Social to Political Identity: A Critical Examination of Social Identity Theory. *Political Psychology*, 22(1):127–156. [22](#)
- Hughes, L. (2006). Beyond the Rules of the Game, Why Are Rooie Rules Nice. In Manning, F. E., editor, *The Game Design Reader*, pages 504–516. Leisure Press. [23](#)
- Janis, I. L. (1982). *Groupthink: Psychological Studies of Policy Decisions and Fiascoes*. Houghton Mifflin, 2nd edition. [12](#)

- Johnson, D. W. and Johnson, R. T. (2009). An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. *Educational Researcher*, 38(5):365–379. [11](#)
- Johnson, S. D., Suriya, C., Won Yoon, S., Berrett, J. V., and La Fleur, J. (2002). Team development and group processes of virtual learning teams. *Computers & Education*, 39(4):379–393. [25](#)
- Juul, J. (2005). *Half-Real: Video Games between Real Rules and Fictional Worlds*. MIT Press, IT University of Copenhagen, Glentevej 67, 2400 Copenhagen NV. [16](#)
- Karau, S. and Williams, K. (1993). Social Loafing : A Meta-Analytic Review and Theoretical Integration. *Journal of Personality and Social Psychology*, 65(4):681–706. [21](#), [23](#), [95](#), [110](#)
- Kellerman, H. (1981). The Deep Structures of Group Cohesion. In Kellerman, H., editor, *Group Cohesion: Theoretical and Clinical Perspectives*, chapter 1, pages 3–21. Grune & Stratton, Inc. [16](#)
- Kempa, R. F. and Ayob, A. (1995). Learning from group work in science. *International Journal of Science Education*, 17(6):743–754. [23](#)
- Keyton, J. (1991). Evaluating Individual Group Member Satisfaction as a Situational Variable. *Small Group Research*, 22(2):200–219. [20](#), [21](#)
- King, E. B., Hebl, M. R., and Beal, D. J. (2009). Conflict and Cooperation in Diverse Workgroups. *Journal of Social Issues*, 65(2):261–285. [12](#), [19](#), [88](#), [93](#)
- Kirman, B. (2013). Tribal metaphors in social game design: creating conflict and camaraderie through context. *Proceedings of CHI 2013 Workshop on Designing and Evaluating Sociability in Online Video Games*, pages 1–6. [17](#)
- Kirman, B., Collovà, F., Davide, F., Ferrari, E., Freeman, J., Shaun, L., Conor, L., and Ravaja, N. (2011). Social architecture and the emergence of power laws in online social games. In *Think Design Play: The fifth international conference of the Digital Research Association (DIGRA)*, pages 1–14. DiGRA/Utrecht School of the Arts. [16](#), [24](#), [28](#)
- Knizia, R. (2004). The Design and Testing of the Board Game Lord of the Rings. In Salen, K. and Zimmerman, E., editors, *Rules of Play: Game Design Fundamentals*, pages 22–27. MIT Press. [1](#), [8](#), [81](#)

- Kümmerli, R., Colliard, C., Fiechter, N., Petitpierre, B., Russier, F., and Keller, L. (2007). Human cooperation in social dilemmas: comparing the Snowdrift game with the Prisoner's Dilemma. *Proceedings. Biological sciences / The Royal Society*, 274(1628):2965–70. [94](#), [109](#)
- Latane, B., Williams, K., and Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology*, 37(6):822–832. [21](#)
- Lessig, L. (2006). *Code: And Other Laws of Cyberspace, Version 2.0*. Basic Books, kindle edition. [23](#)
- Linderoth, J. (2011). Exploring Anonymity in Cooperative Board Games. In *DiGRA 2011*. [9](#)
- Lou, J., Park, K., Cha, M., and Park, J. (2013). Gender swapping and user behaviors in online social games. In *Proceedings of the 22nd International World Wide Web Conference*, pages 827–836. [92](#), [94](#), [109](#), [118](#)
- Maccoby, E. E. (1990). Gender and relationships. A developmental account. *The American psychologist*, 45(4):513–20. [94](#), [95](#), [108](#), [109](#)
- Martey, R. M., Stromer-Galley, J., Banks, J., Wu, J., and Consalvo, M. (2014). The strategic female: gender-switching and player behavior in online games. *Information, Communication & Society*, 17(3):286–300. [92](#), [118](#)
- Martin, E. and Good, J. (2013a). A Study of Team Cohesion and Player Satisfaction in two Face-to- Face Games. In *Proceedings of DiGRA 2013*, number 2007, page Paper 288.
- Martin, E. and Good, J. (2013b). The Relationship Between Game Rules And Team Cohesion : An Empirical Study. In Christou, G., Law, E. L.-C., Geerts, D., Nacke, L. E., and Zaphiris, P., editors, *CHI2013 workshop on Designing and Evaluating Sociability in Online Video Games*, pages 1–4.
- Martin, E. and Good, J. (2014). Strategy, team cohesion and team member satisfaction: The effects of gender and group composition. *Computers in Human Behavior*. [6](#)
- Martin, E., Good, J., and Jackson, J. (2012). Game Rules And Their Effect On Team Cohesion. In Bernhaupt, R., Isbister, K., Mueller, F. F., and Winckler, M., editors,

- Extended Proceedings of the 4th International Conference on Fun and Games*, pages 38–39, Toulouse, France. IRIT Press.
- Nosek, B. a. and Banaji, M. R. (2001). The Go/No-Go Association Task. *Social Cognition*, 19(6):625–666. [93](#)
- Oakes, P. (1987). The Salience of Social Categories. In Turner, J. C., editor, *Rediscovering the Social Group: A Self-Categorization Theory*, chapter 6, pages 117–141. Basil Blackwell, 1 edition. [3](#), [18](#)
- Oakley, A. (1985). *Sex, Gender & Society*. Gower Publishing Company Limited, 2nd editio edition. [90](#)
- Olaniran, B. a. (1996). A model of group satisfaction in computer-mediated communication and face-to-face meetings. *Behaviour & Information Technology*, 15(1):24–36. [20](#), [21](#)
- Park, W. M., English, B. C., Gray, M. D., and Cleland, C. L. (1995). Experiential learning through participation in Green Revolution/Exaction: a role-playing simulation. *Review of Agricultural Economics*, 17:257–265. [13](#), [49](#)
- Pasin, F. and Giroux, H. (2011). The impact of a simulation game on operations management education. *Computers & Education*, 57(1):1240–1254. [11](#)
- Reicher, S. D., Spears, R., and Postmes, T. (1995). A Social Identity Model of Deindividuation Phenomena. *European Review of Social Psychology*, 6(1):161–198. [18](#), [40](#), [76](#), [81](#), [113](#)
- Reisman, J. (1990). Intimacy in same-sex friendships. *Sex Roles*, 23(1-2):65–82. [93](#), [109](#)
- Roberts, G. (1994). Brother to Brother: American African Modes of Relating Among Men. *Journal of Black Studies*, 24(4):379–390. [93](#)
- Royse, P., Lee, J., Undrahbuyan, B., Hopson, M., and Consalvo, M. (2007). Women and games: technologies of the gendered self. *New Media & Society*, 9(4):555–576. [91](#)
- Rudman, L. a. and Goodwin, S. a. (2004). Gender differences in automatic in-group bias: why do women like women more than men like men? *Journal of personality and social psychology*, 87(4):494–509. [93](#), [108](#)

- Savicki, V., Kelley, M., and Lingenfelter, D. (1996a). Gender and group composition in small task groups using computer-mediated communication. *Computers in Human Behavior*, 12(2):209–224. [20](#), [93](#), [94](#)
- Savicki, V., Kelley, M., and Lingenfelter, D. (1996b). Gender, group composition, and task type in small task groups using computer-mediated communication. *Computers in Human Behavior*, 12(4):549–565. [94](#)
- Shaw, J., Duffy, M., and Stark, E. (2000). Interdependence and Preference for Group Work: Main and Congruence Effects on the Satisfaction and Performance of Group Members. *Journal of Management*, 26(2). [23](#)
- Smith, J. H. (2006). *Plans and Purposes: How Videogame Goals Shape Player Behaviour*. PhD thesis, IT University of Copenhagen. [46](#), [95](#)
- Sniderman, S. (2006). Unwritten Rules. In *The Game Design Reader*, pages 476–502. MIT Press. [23](#)
- Spears, R., Doosje, B., and Ellemers, N. (1999). Commitment and the Context of Social Perception. In Ellemers, N., Spears, R., and Doosje, B., editors, *Social Identity*, chapter 3, pages 59–83. Blackwell Publishers Ltd. [3](#), [17](#), [20](#)
- Spears, R., Lea, M., and Lee, S. (1990). De-individuation and group polarization in computer-mediated communication. *British Journal of Social Psychology*, 29(2):121–134. [18](#)
- Staggers, J., Garcia, S., and Nagelhout, E. (2008). Teamwork Through Team Building: Face-to-Face to Online. *Business Communication Quarterly*, 71(4):472–487. [25](#)
- Stark, E. M., Shaw, J. D., and Duffy, M. K. (2007). Preference for Group Work, Winning Orientation, and Social Loafing Behavior in Groups. *Group & Organization Management*, 32(6):699–723. [23](#)
- Stouten, J., De Cremer, D., and van Dijk, E. (2006). Violating equality in social dilemmas: emotional and retributive reactions as a function of trust, attribution, and honesty. *Personality & Social Psychology Bulletin*, 32(7):894–906. [21](#)
- Tajfel, H. U. o. B. and Turner, J. U. o. B. (1979). An integrative theory of intergroup conflict. In Austin, W. and Worchel, S., editors, *The Social Psychology of Intergroup Relations*, chapter 3, pages 33–47. Brooks/Cole, Monterey, CA. [2](#), [17](#), [93](#)

- Terry, P. C., Carron, A. V., Pink, M. J., Lane, A. M., Jones, G. J. W., and Hall, M. P. (2000). Perceptions of group cohesion and mood in sport teams. *Group Dynamics: Theory, Research, and Practice*, 4(3):244–253. [16](#)
- Tidwell, L. C. and Walther, J. B. (2002). Computer-Mediated Communication Effects on Disclosure, Impressions, and Interpersonal Evaluations: Getting to Know One Another a Bit at a Time. *Human Communication Research*, 28(3):317–348. [34](#)
- Tolkien, J. R. R. (1954). *The Lord of the Rings*. HarperCollins, reprint ed edition. [29](#)
- Tuckman, B. W. and Jensen, M. a. C. (1977). Stages of Small-Group Development Revisited. *Group & Organization Management*, 2(4):419–427. [2](#), [14](#), [15](#)
- Turner, J. C. (1999). Some Current Issues in Research on Social Identity and Self-categorization Theories. In Ellemers, N., Spears, R., and Doosje, B., editors, *Social Identity*, chapter 1, pages 6–34. Blackwell Publishers Ltd. [17](#), [41](#)
- Van den Bossche, P., Gijssels, W. H., Segers, M., and Kirschner, P. A. (2006). Social and Cognitive Factors Driving Teamwork in Collaborative Learning Environments: Team Learning Beliefs and Behaviors. *Small Group Research*, 37(5):490–521. [11](#)
- Van Geel, I. (2012). MMOData Charts v3.8. [1](#)
- van Vianen, A. E. and De Dreu, C. K. (2001). Personality in teams: Its relationship to social cohesion, task cohesion, and team performance. *European Journal of Work and Organizational Psychology*, 10(2):97–120. [22](#)
- Wagner III, J. A. (1995). Studies of individualism-collectivism: Effects on cooperation in groups. *Academy of Management journal*, 38(1). [23](#), [119](#)
- Wallace, J. R., Pape, J., Chang, Y.-L. B., McClelland, P. J., Graham, T. N., Scott, S. D., and Hancock, M. (2012). Exploring automation in digital tabletop board game. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work Companion - CSCW '12*, page 231, New York, New York, USA. ACM Press. [24](#)
- Webb, N. M. (1982). Group composition, group interaction, and achievement in cooperative small groups. *Journal of Educational Psychology*, 74(4):475–484. [23](#)
- Webb, N. M. and Cullian, L. K. (1983). Group Interaction and Achievement in Small Groups: Stability Over Time. *American Educational Research Journal*, 20(3):411–423. [23](#)

- Webster, J. and Wong, W. (2008). Comparing traditional and virtual group forms: identity, communication and trust in naturally occurring project teams. *The International Journal of Human Resource Management*, 19(1):41–62. [24](#)
- Wenger, E. (1999). *Communities of Practice: Learning, Meaning, and Identity (Learning in Doing: Social, Cognitive and Computational Perspectives)*. Cambridge University Press, 1 edition. [2](#), [15](#)
- Williams, D., Consalvo, M., Caplan, S., and Yee, N. (2009). Looking for Gender: Gender Roles and Behaviors Among Online Gamers. *Journal of Communication*, 59(4):700–725. [91](#)
- Williams, D., Ducheneaut, N., Xiong, L., Zhang, Y., Yee, N., and Nickell, E. (2006). From Tree House to Barracks: The Social Life of Guilds in World of Warcraft. *Games and Culture*, 1(4):338–361. [1](#), [10](#), [11](#), [16](#)
- Yee, N. (2006a). Motivations for play in online games. *Cyberpsychology & behavior*, 9(6):772–775. [91](#)
- Yee, N. (2006b). The Labor of Fun: How Video Games Blur the Boundaries of Work and Play. *Games and Culture*, 1(1):68–71. [10](#)
- Yee, N. (2008). Maps of Digital Desires: Exploring the Topography of Gender and Play in Online Games. In Kafai, Y. B., Heeter, C., Denner, J., and Sun, J. Y., editors, *Beyond Barbie & Mortal Kombat: New Perspectives on Gender and Gaming*, chapter Chapter 6, pages 83–96. MIT Press. [91](#)
- Yee, N. (2009). Game Studies - Befriending Ogres and Wood-Elves: Relationship Formation and The Social Architecture of Norrath. *Game Studies*, 9(1). [16](#)
- Zander, A. (1979). The Psychology of Group Processes. *Annual Review of Psychology*, 30(1):417–451. [16](#)
- Zavalloni, M. (1973). Social identity : Perspectives and prospects. *Social Science Information*, 12(3):65–91. [20](#)

Appendix A

Questionnaire for a Study of Team-Based Game-Play

This questionnaire was used for all studies. See Chapter [3](#) for more details.

Questionnaire for a Study of Team-Based Game-Play

Section 1

1.1) Age:

1.2) Gender:

- ☐ Male
☐ Female

1.3) In general, do you enjoy working in groups?

- ☐ Yes, I work best in groups
☐ It depends on the work and the group.
☐ No, I much prefer working alone.

1.4) Did you know the other people playing the game with you before today?

- ☐ Yes, I knew everyone else.
☐ Yes, I knew most people.
☐ I knew some people, but there were quite a few I didn't know.
☐ No, I hardly knew anyone.
☐ No, I knew no one else.

Section 2 – In the following questions the word **team** refers to the players that you shared food-producing responsibility with throughout the game.

2) What was your household/team name?

To what extent do you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Slightly Disagree	Neither agree nor disagree	Slightly Agree	Agree	Strongly Agree
2.1) I was happy that the team made sensible decisions with the information and resources they had available.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2) Our team had difficulty reaching decisions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3) I had a lot in common with the other team members.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.4) The team bonded well.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.5) In view of the way I played the game, I should have been part of a different team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.6) I would like to play another game with this team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.7) There were serious breakdowns in communication within the team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8) I would have made different decisions playing on my own.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Disagree	Disagree	Slightly Disagree	Neither agree nor disagree	Slightly Agree	Agree	Strongly Agree
2.9) I think I might have preferred to be in a different team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.10) I am glad I ended up in this team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.11) The team made better decisions than I would have on my own.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.12) I felt my opinion was heard and valued even if the decisions the team reached were different.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.13) The team achieved the best outcome it could have for the team as a whole.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.14) I am happy with the way the other members in the team played the game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.15) I feel my approach to decision-making was well matched to the team approach.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.16) I would like to continue being a part of the team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.17) I was not as successful as I could have been if the team had made different decisions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.18) Some team members didn't participate in the decision-making process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.19) Team members were able to express themselves freely and easily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.20) I was more successful as part of the team than I would have been on my own.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.21) I enjoyed being a part of the team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.22) It was difficult to communicate with the other members of the team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.23) I feel I would have made better decisions than the team did.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.24) The decisions made didn't favour any particular team member over the duration of the game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you for your participation today!

Appendix B

Participant Information Sheet

All participants received a copy of this information sheet.



University of Sussex

Participant Information Sheet for a Study of Team-Based Game-Play

I am carrying out a study into the way that the rules of a game affect the way that players interact together during the game. The information obtained will be used to help design an online, multi-player game, which aims to replicate the relationships found in offline games as closely as possible.

As a participant in one of the games I am researching, you have been invited to contribute to the study. It is entirely up to you whether or not you want to take part in the study, and you can still participate in the game in exactly the same way regardless of your decision.

If you do decide to take part in the study you will be asked to complete a short questionnaire at the end of the game. The questionnaire should take around 15 minutes to complete, and should be returned to me once completed. Your answers to this questionnaire will remain anonymous. Even if you do choose to participate you may later ask for this data to be deleted from the experiment at any point up until March 2013.

If you wish to see an overview of the results please contact me at e.martin@sussex.ac.uk. Further information on the progress of the game design can be found at <http://www.informatics.sussex.ac.uk/research/projects/greenrev/>. The results will also be used as part of my thesis for a DPhil from the School of Engineering and Informatics at the University of Sussex. This thesis will eventually be available from Sussex Research Online.

Thank you very much for taking the time to read this information sheet.

Yours sincerely,

Eleanor Martin

Appendix C

Participant Consent Form

All participants received a copy of this consent form. The completed forms were collected along with the complete questionnaire at the end of the game.

Study of Team-Based Game-Play Consent

I hope that you enjoy playing the game today as part of the study of team-based game-play. I'd like your permission to use some of your information in the research project. Your participation will help us to improve the design of a new online game.

Your name will never be connected to the research results or released to anyone outside the project; a pseudonym will be used. Information that would make it possible to identify you will never be included in any sort of report, or disclosed outside the project, unless explicit permission has been given for use.

Your name: _____

Your date of birth: _____

- Do you agree to take part in the study of team-based game-play?
☐ Yes ☐ No
- Sometimes we write articles or give presentations about games and learning. Is it OK to include your comments when we do this?
☐ Yes ☐ No
- Sometimes we write articles or give presentations about games and learning. Is it OK to include pictures of you when we do this?
☐ Yes ☐ No
- Sometimes information about the project may be published on the web or in print or broadcast media. Is it ok to include pictures of you in these cases?
☐ Yes ☐ No

Signed: _____

Date: _____

Thank you.